

Tioga Creek Subwatershed Density Management

Umpqua Resource Area Field Office

Coos Bay District

Bureau of Land Management

Environmental Assessment OR 125 - 99 - 05



Prepared this day the 1st day of July, 2002

Mickey Bailey	Forester/Natural Resource Specialist - Team Lead
Paul Fontaine	Forester
Frank Price	Forest Ecologist
Kathy Wall	Wildlife Biologist
Larry Standley	Hydrologist
Tim Barnes	Soil Scientist/Geologist
Pat Olmstead	Fisheries Biologist
Estella Morgan	Botanist, Umpqua Field Office
Scott Knowles	Natural Resource Specialist
Steve Samuels	Cultural Specialist
Tim Votaw	Hazardous Materials Coordinator
Bill Elam	Fuels Specialist
Nancy Zepf	Recreation Specialist
Terry Evans	Forester

Table of Contents

CH. 1 - PURPOSE OF AND NEED FOR ACTION	1
Background.....	1
Tiering/Incorporate by Reference	2
Scoping	2
Location of the Proposed Project.....	3
Issues Concerning the Proposed Project.....	3
Management Objectives	3
CH. 2 - ALTERNATIVES INCLUDING THE PROPOSED ACTION.....	4
Introduction	4
No Action Alternative.....	4
Proposed Action Alternative.....	4
Prescriptions.....	4
Harvesting Methods	6
Project Design Features - Harvest	6
Project Design Features for Road Construction, Renovation/Improvement, Decommissioning.....	8
Project Design Features Rock Quarry Locations.....	10
Project Design Features for Fuels Management.....	10
Project Design Features for Snag and Coarse Woody Debris Creation.....	12
Project Design Features for In-Stream Restoration	12
Project Design Features for Botany.....	13
Project Design Features for Port-Orford Cedar	13
Project Design Features for Noxious Weeds.....	13
Project Design Features for Northern Spotted Owl.....	14
Project Design Features forMarbled Murrelet.....	14
Project Design Features for Special Status Species.....	14
Project Design Features for Recreation/Cultural	14
Project Design Features for Solid and Hazardous Waste	15
Alternatives Identified but Eliminated from further Analysis	15
CH. 3 - DESCRIPTION OF THE AFFECTED ENVIRONMENT	15
Introduction	15
Vegetation.....	16
Wildlife	19
Special Status Wildlife Species	19
Survey and Manage Wildlife Species.....	20
Special Habitats.....	21
Riparian Reserves Species.....	21
General Habitat and Associated Wildlife	21
Fisheries and Aquatic Habitats	22
Fish Species of Concern	22
Aquatic Habitat Features	22
Aquatic and Fisheries Habitat Management.....	23
Stream stabilization	24
Soils	24
Hydrology.....	25
Stream Flow	25
Water Quality	25
Channel Condition and Large Wood.....	26
Botany	26
Threatened & Endangered Survey & Manage Species.....	26
Port-Orford Cedar.....	27
Noxious Weeds.....	27
Recreation	27
Area of Critical Environmental Concern	29
Cultural Resources.....	29

Fuels Management.....	29
Solid & Hazardous Materials.....	29
Environmental Justice.....	29
Road Densities.....	30
In-Stream Restoration.....	30
 CH. 4 - ENVIRONMENTAL CONSEQUENCES.....	 31
Vegetation - No Action - Density Management	31
Vegetation - No action -Alder Conversion	31
Vegetation - Proposed Action - Density Management	32
Vegetation - Proposed Action - Alder Conversion	34
Wildlife - No Action.....	35
Special Status / Survey & Manage Species.....	35
General Habitat and Associated Wildlife	35
Cumulative Effects.....	36
Wildlife - Proposed Action.....	36
Density Management.....	36
Special Status/ Survey and Manage Species	36
General habitat and associated wildlife.....	38
Alder Conversion	39
New Road Construction	39
Road Renovation/Improvement.....	39
Road Closure/Decommissioning	40
Rock Quarries	40
Snag Creation.....	40
Coarse Woody Debris Creation.....	40
In-Stream Restoration	40
Cumulative Effects.....	41
Fisheries- Aquatic Habitats/Riparian Habitats, Including Special Status Fish - No Action	41
Special Status Species - Fish	41
Aquatic Habitat/Fisheries Habitat	42
In-stream Restoration	42
Riparian Functions - Shading	42
Streambank stabilization	43
Controlling sediment movement	43
Contributing coarse woody debris.....	43
Contributing organic litter.....	43
Fisheries -Impacts on Aquatic Habitats/Riparian Habitats, Special Status Fish - Proposed Action	
Density Management.....	44
Special Status Species - Fish	44
Stream Shading	44
Streambank Stabilization	44
Controlling Sediment Movement.....	44
Contributing Coarse Woody Debris.....	45
Organic Litter.....	45
Alder Conversions.....	45
Stream Shading	45
Streambank Stabilization	46
Controlling Sediment Movement.....	46
Contributing Coarse Woody Debris.....	46
Organic Litter.....	46
Yarding Corridors.....	46
Stream Shading	47
Streambank Stabilization	47
Controlling Sediment Movement.....	47
Contributing Coarse Woody Debris.....	47
Organic Litter.....	47
Road Construction/Improvement/Renovation/Haul Routes	48

Stream Shading	48
Streambank Stabilization.....	48
Controlling Sediment Movement	48
Contributing Coarse Woody Debris	48
Organic Litter	48
In-Stream Restoration - Coarse Woody Debris Placement	48
Soils - No Action	49
Soils - Proposed Action	49
Hydrology - No Action.....	50
Stream Flow	50
Water Quality	50
Channel Condition and Large Wood.....	51
Hydrology - Proposed Action.....	51
Density Management.....	51
Stream Flow	52
Water Quality.....	53
Channel Condition and Large Wood.....	53
Alder Conversion / Site Preparation / Planting	54
Stream Flow	54
Water Quality.....	54
Channel Condition and Large Wood.....	54
New Road Construction	55
Stream Flow	55
Water Quality.....	55
Road Renovation/Improvement.....	55
Road Closure/Decommissioning	55
In-Stream Restoration and Culvert Replacement and Upgrading	55
Prescribed Burning / Slash Pile Burning for Understory Development	56
Haul Routes	56
Consistency with the Aquatic Conservation Strategy Objectives	56
Botany - No Action.....	59
Botany - Proposed Action.....	59
Density Management	59
Alder Conversion	60
Road Construction.....	60
Road Renovation/Improvement/Maintenance	60
Road Closure/Decommission	60
Snag Creation/Coarse Woody Debris.....	60
Port-Orford Cedar - No Action.....	61
Port-Orford Cedar - Proposed Action.....	61
Snag Creation & Coarse Woody Debris Creation & In-stream Restoration.....	61
Noxious Weeds - No Action.....	61
Noxious Weeds - Proposed Action.....	61
Alder Conversion	62
Fuels Management	62
Road Construction & Road Renovation/Improvement/Maintenance/Decommissioning.....	62
Snag Creation & In-stream Restoration & Coarse Woody Debris	62
Fuels Management - No Action.....	62
Fuels Management - Proposed Action.....	63
Recreation - No Action.....	63
Recreation - Proposed Action.....	63
Area of Critical Environmental Concern	64
Cultural Resources - No Action.....	64
Cultural Resources - Proposed Action.....	64
Solid & Hazardous Materials - No Action.....	64
Solid & Hazardous Materials - Proposed Action.....	64
Energy Exploration, Development, Production, and Transportation - No Action	64
Energy Exploration, Development, Production, and Transportation Proposed Action.....	64

References.....	65
-----------------	----

Table 1 - In-stream Restoration Opportunities Within Tioga Creek Subwatershed	13
Table 2 - Tioga Creek Subwatershed Acreage Table	16
Table 3 - Age Classes within Tioga Creek Watershed	17
Table 4 - Current Stand Conditions	18
Table 5 - Alder Conversion Units	19
Table 6 - Tioga Creek Subwatershed Existing Stream Density Summary	25
Table 7 - Current Road mileages with the Tioga Creek Subwatershed, 1994 to present	30
Table 8 - Projected age Stands Would Attain Desired Tree and Snag Diameters	33
Table 9 - Compaction Summary	50
Table 10 - Location of Thinning Areas by Drainage	51
Table 11 - Location of Alder Conversion Areas by Drainage	54
Figure 1 - Fire Road CT 120 tpa post harvest	05
Figure 2 - Scare Ridge CT 80 tpa post harvest	05
Figure 3 - Scare Ridge CT 60-80 tpa post harvest	05
Figure 4 - Hatcher Creek Unit 5a Relative Density =69	17
Figure 5 - Hatcher Creek Unit 5a - Crown Closure	31
Figure 6 - Alder Stand within Tioga DM	31
Figure 7 - Fire Road CT 120 tpa Crown Closure	32
Figure 8 - Scare Ridge CT 80 tpa Crown Closure	34

Appendix A Maps

Project Vicinity Map

Project Location Map Proposed Density Management Units

FOI Age Classes and Proposed Density Management Units

Appendix B Prescription and Logging Summary

Table B 1 - Detailed Proposed Prescription

Table B 2 - Whole or Partial Units Deferred

Table B 3 - Logging Methods and Stream Crossing Summary

Appendix C Road Related Activities

Table C 1 - Project Related Road Activities

Table C 2 - Non-Project Area Roads for Potential Decommissioning

Appendix D Snags and Coarse Woody Debris Management

Snag and Coarse Woody Debris Management

Table D 1 - Summary of CWD and Snag Transects...

Appendix E Soil Types and Erosional/Compaction Hazards

Table E 1 - Soil Type by Proposed Density Management Units

Table E 2 - Soil Erosion Susceptibility and Compaction Hazard

Appendix F- Fisheries Effects Determination

Table F 1 – Evaluation Criteria and Effects Determination for Tioga Density Management Units

CH. 1 - PURPOSE OF AND NEED FOR ACTION

Background

The Bureau of Land Management proposes to implement conifer thinning, alder conversion, road construction/decommissioning, coarse woody debris/snag recruitment, and riparian restoration projects for the purpose of improving the late-successional habitat within the Tioga Creek Subwatershed. This environmental assessment (OR125-99-05) will address site specific, direct, indirect, and cumulative effects for the above proposed projects.

Late-Successional Reserves are to be managed to protect and enhance conditions of late-successional and old growth forest ecosystems. These lands are to serve as habitat for late-successional and old-growth associated species including the northern spotted owl. Many of the forest lands designated as Late-Successional Reserve within the southern Oregon Coast Range consist of forest stands less than 80 years of age, and thus are not considered late-successional forest. Silvicultural treatments in managed stands less than 80 years of age offer the opportunity to reduce the density of overstocked stands, increase tree species diversity, improve forest structural characteristics, and to add coarse woody debris. Such treatments are likely to result in forest stands that more closely approximate the structure and function of a late-successional forest. Silvicultural treatments can accelerate the development of young stands into multilayered stands with large trees and diverse plant species, and provide habitat structures that will, in turn, maintain or enhance species diversity. Tappenier et al. (1997) observed old-growth trees often averaged 20 inches in diameter at age 50 and 40 inches at age 100. This individual tree growth rate is higher than observed in similar aged plantations. Hence, for many forest stands within Late-Successional Reserves of the Oregon Coast Range, treatments such as thinning snag creation, and coarse woody debris creation can accelerate the attainment of late-successional forest conditions across the landscape.

In May of 1998, an interagency team of specialists from the Bureau of Land Management, U.S. Forest Service, and U.S. Fish and Wildlife Service completed the *South Coast - Northern Klamath Late-Successional Reserve Assessment* (hereafter referred as Late-Successional Reserve Assessment) (Interagency, 1998). This document provides guidance for determining which forest stand conditions would warrant silvicultural treatment and what types of treatments would be appropriate to achieve desired forest stand conditions. The proposed action and all alternatives described in this environmental assessment have been designed to be consistent with the guidance outlined in the Late-Successional Reserve Assessment.

The Late-Successional Reserve Assessment listed Late-Successional Reserve #261 as a high priority area for management actions based on its large size, key links to the Late-Successional Reserve network, and land ownership pattern. The Tioga Subwatershed, located within Late Successional Reserve #261, was selected as the project area. The Tioga Creek Subwatershed is also a Tier 1 key watershed, meaning that it has been determined to contribute directly to the conservation of at-risk anadromous salmonids and resident fish species, and has a high potential of responding to restoration efforts.

An interdisciplinary core team within the Umpqua Field Office was given the task to develop a project proposal that will move forest stands toward late-successional conditions as required by the *Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-growth Forest Related Species Within the Range of the Northern Spotted Owl* (hereafter referred to Northwest Forest Plan) and its *Record of Decision* (Interagency, 1994). The team began prioritizing areas within the Tioga Subwatershed that would benefit from treatments and contribute to the recovery of Late-Successional Reserve conditions across the landscape. Field analysis of stand conditions was completed to develop the appropriate prescriptions for each stand based on historic fire regimes, topography, and stand exam data. The proposed projects described herein, are intended to implement a subset of specific management opportunities that were identified within the *South Fork Coos Watershed Analysis* (South Fork Coos WA, USDI-BLM, 2001), the *East Fork Coquille Watershed Analysis* (East Fork Coquille WA, USDI-BLM, 2000), and the Late-Successional Reserve Assessment in a manner consistent with the standards and guidelines outlined in existing planning documents described below.

The Bureau of Land Management, along with other federal agencies, is under direction by the Northwest Forest Plan to conduct watershed restoration projects to aid in the recovery of water quality, aquatic, riparian, and terrestrial habitats. A watershed analysis is required prior to certain management activities within a Key Watershed. The *South Fork Coos Watershed Analysis* and the *East Fork Coquille Watershed Analysis* outlined several management opportunities for restoring and enhancing ecosystem conditions. Among the opportunities listed within the analyses were density management treatment; alder stand conversion, road renovation, coarse woody debris/snag enhancement, and in-stream restoration.

Tiering/Incorporate by Reference

This environmental assessment is tiered to the *Coos Bay District Resource Management Plan* and its *Record of Decision* (RMP-ROD, USDI-BLM, 1995); which is in conformance with the *Northwest Forest Plan* and its *Record of Decision*. This environmental assessment is also tiered to the *Final Environmental Impact Statement for Amendment to the Survey and Manage, Protection Buffer, and other Mitigating Measures Standards and Guidelines* and its *Record of Decision* (S&M ROD, Interagency, 2001).

This environmental assessment incorporates by reference the *South Fork Coos and East Fork Coquille Watershed Analyses, South Coast - Northern Klamath Late-Successional Reserve Assessment*, and the *Draft Western Oregon Districts Transportation Management Plan* (TMP, USDI-BLM, 2001).

Actions described in this environmental assessment are designed to be consistent with the Aquatic Conservation Strategy Objectives listed on page B-11 of the Northwest Forest Plan - Record of Decision.

All of the documents are available for review at the Coos Bay District Office of the Bureau of Land Management, during regular business hours. Some of the documents are available at the Coos Bay and North Bend Public Libraries, the Coos Bay District's Internet Home Page at <http://www.or.blm.gov/coosbay>, and the Oregon State Office of the Bureau of Land Management in Portland, Oregon. These documents will be available on the Coos Bay District's Internet Home Page at <http://www.or.blm.gov/coosbay>.

The analysis file for this environmental assessment is located at the Coos Bay District Office and is hereby incorporated by reference. The analysis file contains additional information, public input, and specialists' reports that were used by the interdisciplinary team to analyze impacts and alternatives.

Scoping

A scoping process identified agency and public concerns related to the proposed projects and defined the issues and alternatives to be examined in detail during the environmental assessment process. Scoping for Tioga Creek Density Management was 30 days, from August 2, 1999 to August 31, 1999. The general public was notified of the planned environmental assessment through the publication of the Coos Bay District's *Planning Update* and a Public Notice was published in *The World* newspaper. Scoping letters and/or e-mail were sent to a mailing list of individuals, agencies, and organizations that have requested project notification. Scoping letters were also sent to adjacent landowners to inform them of the project proposals.

List of Adjacent Landowners Contacted

Menasha Corporation
Roseburg Resources Co.
Weyerhaeuser

List of Individuals, Agencies & Organizations Contacted

Association of O&C Counties
Coast Range Association
Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians
Coos County Board of Commissioners
Coquille Indian Tribe
Oregon Department of Forestry
Department of Land Conservation and Development
Division of State Lands
Donald Fontenot
Governors Natural Resources Office
Hugh Kern
Kalmiopsis Audubon Society
Many Rivers Group
Native Plant Society of Oregon
NOAA National Marine Fisheries Service
ODA - Noxious Weed Control Program
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife

Oregon Natural Resources Council
Rogue Forest Protective Association
Sierra Club
Southern Oregon Timber Industries Association
State Historic Preservation Office
Umpqua Watersheds
Water Resources Department

List of Scoping Respondents

Jim Clarke, Weyerhaeuser
Francis Eatherington, Umpqua Watersheds, Inc.

Location of the Proposed Project

The proposed projects will occur within the Late-Successional Reserve and Riparian Reserve land use allocations, as designated by the *Coos Bay District Resource Management Plan and Record of Decision*. Since it is understood that these land use allocations overlap, this document will generally describe the area as Late-Successional Reserve.

These proposed projects are primarily within the mapped Late-Successional Reserve boundaries of the Tioga Creek Subwatershed. Minor portions of the proposed project overlap into the Brummit Creek Subwatershed. The area considered for analysis is located approximately 20 miles northeast of Coquille. The South Fork of the Coos River is the main tributary for which the Lower Tioga Creek, Middle Tioga Creek, Upper Tioga Creek and Burnt Creek drainages flow into. The total area within the subwatershed considered for analysis is 24,654 acres. The remaining interior adjacent lands are privately owned. The proposed project is located within Coos County, T. 26 S., R. 09 W., T. 26 S., R. 10 W., T. 27 S., R. 09 W., T. 27 S., R. 10 W., Willamette Meridian. See Appendix A Maps for Sale Vicinity and Location Maps. Individual Unit maps are in the Analysis File and are available upon request.

Issues Concerning the Proposed Project

Forest stands are not currently on a trajectory to achieve late successional and old growth habitat characteristics. Individual trees within managed young-growth stands are developing under greater competition than the conditions that dominant conifers would have grown in naturally regenerated old-growth stands at an equivalent age (Tappenier et al., 1997). Increased growing space of individual trees has a direct correlation to stand stability and unstable stands are more subject to windthrow (Wilson and Oliver, 2000). Therefore, reducing stand densities is necessary to maintain a growth trajectory and improve stand stability to meet the Late-Successional Reserve objectives.

Stream bank stability, soil erosion, soil compaction.

Management Objectives

Implement recommendations and management priorities contained in the *South Coast - Northern Klamath Late-Successional Reserve Assessment* to: enlarge existing interior late-successional habitat blocks, improve habitat connections between late-successional reserves, maintain and improve connectivity habitat within late-successional reserves.

Work toward the goals established by the *Draft Western Oregon Districts Transportation Management Plan* for the *South Fork Coos* and *East Fork Coquille Watershed Analyses* areas.

Redirect the stand development of overstocked stands by putting them on a growth trajectory to develop late-successional characteristics, while maintaining native species diversity.

Maintain and/or restore structural habitat complexity typically found in late successional or old growth forests, such as large green trees, large down logs, and snags.

Ensure consistency with Aquatic Conservation Strategy objectives.

Protect and/or restore rare and key habitats (wetlands, cliff habitats, talus habitats, grassy balds or meadows)

Provide cost effective management enabling the implementation of these management objectives while providing collateral economic benefits to society.

CH. 2 - ALTERNATIVES INCLUDING THE PROPOSED ACTION

Introduction

Activities needed to achieve management objectives include thinning, alder conversion, new road construction, road renovation/improvement, road decommissioning, site preparation, snag creation, coarse woody material creation, and in-stream restoration.

No Action Alternative

Under this alternative, forest management activities would not occur at this time for these specific locations. Current forest stand conditions would be left to develop without intervention. Early seral forest stands within the Late-Successional Reserve would not be thinned. Road conditions and densities would remain the same. No closures would be completed. Habitat enhancements, such as the creation of snag/coarse woody material, or in-stream structure restoration would not be implemented.

Proposed Action Alternative

The Bureau of Land Management proposes to implement density management and habitat restoration projects to enlarge existing interior late-successional habitat blocks, improve habitat connections between Late-Successional Reserves, and maintain and improve connectivity habitat within Late-Successional Reserves. Density management treatments are designed to assure and/or speed attainment of habitat attributes associated with late-successional/old-growth forests.

An interdisciplinary team is proposing to treat a total of approximately 2,857 acres that will include about 2,536 acres of thinning, 321 acres of alder conversion, 3.5 miles of new road construction, 35 miles of road renovation/improvement, 15 miles of road decommissioning, 2.25 miles of in-stream restoration, and the creation of about 4,500 snags and downed woody material.

Treatments are to be implemented over roughly a five-year planning cycle. Projects would begin as early as fiscal year 2002.

An additional 508 treatment acres were considered for inclusion with this proposal. An interdisciplinary team reviewed the current conditions of these stands and determined that treatment should be deferred, and therefore dropped from further analysis. See Appendix B to review Table B 2 - Whole or Partial Units Deferred from Analysis.

Prescriptions

Approximately 2,536 acres of young, dense, conifer stands would be treated within 38 separate units. As a result of keeping logical unit boundaries, roughly 70 acres of thinning overlaps into the Brummit Creek Drainage located within the East Fork Coquille Subwatershed. Harvest methods include ground-based (197 acres), skyline cable (1,753 acres), and helicopter (907 acres). Treatments would occur within Late-Successional Reserves and are intended to accelerate development, of the structure and function of late-successional forest condition. Of the 2536 acres of density management, approximately 1,665 acres are also within overlapping Riparian Reserves. A variable width no-harvest buffer would be established around all streams. There would be a no-harvest buffer within 20 feet of a streambank or unstable area near the bank, within 20 feet of the top of the inner gorge, or within 20 feet of the floodplain, whichever is greater. The no-harvest buffer could be expanded on a site-specific basis to provide additional protection. For example, next to fish bearing streams, unstable areas, and along streams in alder conversion units where solar heating is a concern. A width necessary to provide adequate stream shading would be determined by resource area staff depending on stream size, aspect, existing vegetation, and local topography. Functionally, the widest no-harvest buffers needed to protect aquatic values is the width equal to half the height of the overstory trees at the time of treatment (South Fork Coos WA 2000, Ch.14 pg. 10-11). See Appendix B to review Table B 1 - Detailed Proposed Prescription

Some trees felled within or adjacent to the no-harvest buffers will be left on site to meet coarse woody debris objectives.

Where cable yarding is required through the no-harvest buffer, logs will be fully suspended to protect streambanks. Where only partial suspension is feasible, operations over any stream with visible surface flow will occur during the dry season. In addition, trees that are felled within the no-harvest buffer to provide yarding corridors will be dropped toward the stream channel to provide bank armoring and coarse woody debris.

Approximately 3 units and portions of 9 units scattered throughout the Tioga Subwatershed totaling about 321 acres will be cut as alder conversion. Alder conversion would be done to reestablish conifers on sites where conifers had been removed by a past disturbance. Abundant red alder regeneration caused the conifers to fail to establish following the disturbance on those sites. This consists of removing the red alder overstory; slashing the brush, preparing the site for regeneration, and planting a conifer species mix appropriate to the site. Trees may be tubed if animal browsing is a concern at the site.

Density management would be accomplished by retaining healthy, dominant and codominant trees and designating intermediate or suppressed trees for removal, according to one of three proposed thinning prescriptions: (1) wind firmness, (2) provide growing space, and (3) understory development. Species composition would be taken into account, to maintain habitat diversity with species that are determined appropriate for the site. Where feasible, conifers exhibiting unique form or development that would benefit wildlife or botanical species will be reserved from cutting. In addition, minor tree species, which occur on the site, will be retained where possible unless otherwise indicated the unit prescription. Maintain an average canopy closure within treated conifer stands of at least 60% for northern spotted owl dispersal habitat.



Figure 1: Fire Road CT 120tpa Post Harvest

Wind Firmness/Growing Space: This prescription was designed for stands with high stocking levels, smaller average diameters, and small crowns that may be prone to wind throw due to slope position and aspect. Stands would be thinned by retaining approximately 110-120+ trees per acre. Approximately 921 acres would be thinned to this prescription. See Appendix B to review Table B 1 - Detailed Proposed Prescription.

Provide Growing Space/Understory Initiation: This prescription was designed for stands that are currently overstocked, where windthrow is not a concern due to slope position and aspect. Stands would be thinned by retaining approximately 80-90 trees per acre. On north aspects a coarser canopy texture is desired, consistent with historical patterns of stand development and can be accomplished by designating an upper diameter limit cut. The south slopes would have a smoother more uniform texture. Approximately 1242 acres would be thinned to this prescription. See Appendix B to review Table B 1 Detailed Proposed Prescription.



Figure 2 - Scare Ridge CT 80 tpa post harvest



Figure 3 - Scare Ridge CT 60-80 tpa post harvest

Understory Regeneration:

This prescription was designed for stands that have more structural development but are lacking an intermediate canopy or understory layer of vegetation, and/or are at the upper age limit for treatment. Stands would be thinned by retaining approximately 60 to 80 trees per acre and underplanted with shade tolerant conifer species. Approximately 373 acres would be thinned to this prescription. See Table 1 for a more detailed breakdown of units. Thinning prescriptions include no treatment areas, managed known site areas, and stream buffers. These areas also help to enhance habitat diversity. In areas needing a coarser canopy texture with openings an upper diameter limit cut would be used. Gaps created would be planted with species appropriate for the site. See Appendix B to review Table B1 - Detailed Proposed Prescription.

Harvesting Methods

Three logging systems are proposed for harvesting: (1) ground-based cut-to-length harvester, (2) skyline cable, and (3) helicopter. These systems would be used for both thinning and red alder conversion areas. Determining which harvest system to apply in each unit to best meet overall management objectives depends on several variables: terrain, access, protection of resources, minimizing road construction, and minimizing costs. See Appendix B to review Logging Methods and Stream Crossing Summary Table B 3.

Ground-based system

The suitable ground-based logging areas on this project area are the gentle terrain and comprise about 197 acres, or 7%, of the proposed project area. A log harvester and forwarder would be used instead of conventional skidders or crawler tractors. The harvester system is more desirable than conventional tractors as no blades would be used to cut trails and expose soil. The harvester to be used would be a "cut-to-length" log processor system that operates in the following manner: The harvester fells the trees, bucks them to length, and removes the limbs and treetops. The treetops and branches are stripped and placed in front of the harvester to travel on as the trees are cut and decked. Logs are loaded and transported to the landings with a forwarder, which has wide tires to minimize ground disturbances. The forwarder also travels the tree-limb covered paths used by the harvester. Equipment would not be allowed to travel across streams.

Cable logging system

Cable logging would occur in areas that are too steep for ground-based operations, but are accessible with existing roads or short temporary spur roads. The cable system proposed is a small skyline yarder equipped with a clamping carriage capable of yarding laterally 75 feet from the skyroads and transporting logs with one-end suspension. Full suspension would be required over streams. The areas proposed for this type of operation comprise about 1753 acres, or 61% of the proposed project area.

Helicopter logging system

The suitable helicopter logging locations within these projects are not accessible to ground-based equipment, or would require an extensive new road construction for cable access. Helicopter landing pads are generally located at existing clearings or wide spots located on existing roads. If existing landing pads need to be improved, the action will be considered a road improvement. The areas proposed for this type of operation comprise about 907 acres, or 32% of the proposed project area.

Project Design Features - Harvest

No cable yarding will occur during high sap flow from 1 March to 30 June without mitigation such as shielding the base of trees or marking narrow corridors and removing damaged trees upon completion of harvest adjacent to the corridor.

All trees will be bucked to 40 feet maximum log lengths with tops and limbs will be left on-site, as directed by the Authorized Officer.

No ground-based equipment will be permitted to operate in no-harvest areas adjacent to stream channels or on slopes greater than 35%.

Ground-based harvest will be permitted only during the dry season or when soil moisture content is less than 25% as determined by the Authorized Officer.

Within ground-based harvest areas, the number of passes of the forwarder will be kept to a minimum. If there is a need for the forwarder to make multiple passes in an area, the routes will be designated. The equipment will traverse over a bed of slash whenever possible to minimize the amount of soil compaction incurred during operation.

Ground-based equipment would not be permitted to travel through stream channels or within 20 feet of stream banks.

One-end suspension will be required during in-haul of logs during yarding operations. Lift trees and intermediate supports would be required to help attain desired suspension.

Full log suspension would be required for all streams with water flowing in them concurrent with harvest operations. Where full suspension is not feasible operations over any stream with visible surface flow, operation will take place during the dry season.

A variable width no-harvest buffer would be established around all streams. There would be a no-harvest buffer within 20 feet of a streambank or unstable area near the bank, within 20 feet of the top of the inner gorge, or within 20 feet of the floodplain, whichever is greater. The no-harvest buffer could be expanded on a site-specific basis to provide additional protection, such as fish bearing streams, unstable areas, and alder conversion units. A width necessary to provide adequate stream shading would be determined by resource area staff depending on stream size, aspect, existing vegetation, and local topography.

The boundaries of the variable width no-harvest buffer, on all identified fish bearing streams within units 4, 5a, 8, 10, 11, 12a/b, 13b, 14a/b/c, 15, d/h, 18, 20, 21, 24 and 26 will be determined by resource staff.

The location, spacing, and width of cable and ground yarding corridors in the thinning units will be specified prior to cutting.

Uphill cable yarding away from stream channels is preferred when yarding adjacent to stream channels. Where it is necessary to locate a yarding corridor across a stream channel, trees within the no-harvest buffer that need to be cut will be directionally felled toward the stream and left on site.

In general, yarding corridors will be 150 feet apart as measured from the tailhold or where the skyline reaches the far edge of the unit, and a carriage capable of lateral yarding 75 feet either direction from a fixed position on the skyline will be required.

Yarding corridors will not exceed a width of approximately 12 feet. Where possible, rub trees will be left to protect leave trees along the corridors.

Where roads allow, yarding will be done so that corridors are parallel, rather than radiating from one central landing.

All existing snags will be reserved from felling unless they must be felled due to safety concerns.

All existing coarse woody debris will be retained unless identified for removal by the Authorized Officer.

Helicopter operations within approximately ½ mile of a northern spotted owl nest will be restricted between March 1 and September 30.

Helicopter operations within approximately ½ mile of occupied murrelet sites will be restricted between April 1 and August 5.

Non-merchantable tops and limbs will be left on site where the harvest tree was severed.

Within safety standards, all designated harvest trees would be directionally felled away from roads, property lines, posted boundaries, orange painted reserve trees, no-harvest areas, and snags.

Minor species such as bigleaf maple, golden chinquapin, Oregon myrtle, and western red cedar, when present on site, will be retained where possible unless otherwise indicated within the unit prescription.

One tree per 100 linear feet of selected stream channels would be directionally felled toward the stream channel. Trees selected and cut should come from the co-dominant overstory and must touch or cross the stream channel after felling.

Access

Access to units for log hauling would be from existing collector, local, and resource roads. Some of the roads will need renovation or improvement. There will be construction of new resource roads and roadside landings.

Road Construction

New road construction would consist of approximately 3.5 miles of dirt or rocked surface resource roads and landings. New road construction is defined as excavating a road prism where one had not prior existed. The road prism will include design features such as drainage, out sloping, waterbarring and ditchlines. New roads would be constructed on or near ridge top locations and would be single lane width with turnouts. Some landing construction would consist of expanding or creating wider spots on existing roads to facilitate safe yarding and loading of logs. Landings for ground-based, cable, and cut-to-length systems are typically ¼ acre in size including the existing roadbed. The new roads would be decommissioned within one year after operations are completed. No new

roads would be constructed in Riparian Reserves. Some of the roadside landings to be constructed on or adjacent to existing collector, local, or resource roads could be in the upland portions of Riparian Reserves. The dirt surface resource roads would receive seasonal preventative maintenance (storm proofing) prior to onset of winter rains each year during non-hauling periods. This may include, but is not limited to cross ditching, removing ruts, mulching, seeding, and road blocking/barricading. See Appendix C, Table C 1 - Project Related Road Activities for a listing of proposed new roads.

Road construction would incorporate design features to minimize erosion and the capacity to transport sediment. These Best Management Practices (Record of Decision 1995, pp. D3-D4) may include but are not limited to; avoiding fragile or unstable areas, minimizing excavation and height of cuts, end haul of waste material where appropriate and construction during the dry season.

Dirt spurs would be closed or gated during the wet season, for the life of the timber sale contract,

For this proposed project, road mileages will not increase over the 1994 BLM base road miles (see Table 7, page 30) within the Tioga Creek Key Watershed. (Refer to Regional Ecosystem Office memo dated April 7, 1995, titled *Road Access Policy for Key Watersheds*.)

Road Renovation/Improvement

Approximately 35 miles of road renovation/improvement would take place to return existing old roads to their original construction design standard. Actions could include clearing brush/trees, cleaning/replacing culverts, restoring proper drainage/grading, spot rocking, or other maintenance. Road improvement would consist of raising the current standard of a road with some capital improvements. Improvements could include adding culverts, adding rock to existing dirt resource roads, plus renovation activities listed above. See Appendix C, Table C 1 - Project Related Road Activities for a listing of proposed road renovation/improvement.

Road Closure/Decommissioning

All newly constructed resource roads/landings and existing renovated/improved resource roads, used for the proposed project and under the control of the Bureau of Land Management, will be decommissioned within a year after harvesting operations are complete. Full decommissioning as defined by the *Draft Western Oregon Districts Transportation Plan* (USDI BLM, 2001) may include, but is not limited to, subsoiling or tilling, removal of stream crossings and cross drains, construction of functional water bars, stabilizing fill areas, re-vegetation, and blocking vehicle access with a suitable barrier. These methods would be used individually or in combination as needed to reduce potential erosion and to help restore the natural hydrologic flow. The net reduction in road miles from decommissioning would be 15 miles. All decommissioned roads are in the Tioga Creek Key Watershed or on ridge tops that divide the Tioga Creek subwatershed from adjacent subwatersheds. See Appendix C, Table C 1 - Project Related Road Activities for a listing of proposed road decommissioning.

Road Maintenance

All roads used for the project would be maintained in accordance with the district road management plan during the life of the project.

Haul Routes

The following have been identified as major haul routes for transportation of timber. Sediment delivery to streams will be eliminated through the use of silt fencing/straw bale barriers, removal/relocation of trapped sediment to stable upland areas, gravel lifts to stream crossings, and/or dry season hauling.

Sediment filters will be placed at culvert locations as designated by the Authorized Officer where haul-generated sediment is likely to occur from roads during the rain events (generally mid-October to mid-May). Once timber hauling is complete, sediment retained by the filters would be transported to upland locations to prevent subsequent delivery to aquatic resources.

Paved Surface: Coal Creek Road, Tioga Tie Road, Coos River Mainline, Burnt Ridge Road, Burnt Mountain Access Road, and Middle Creek Road.

Project Design Features for Road Construction, Renovation/Improvement, Decommissioning

Road construction, renovation/improvement, and decommissioning associated with the units will not occur 1 March - 30 June within ¼ mile of known NSO sites, and one mile for blasting.

Road construction, renovation/improvement, and decommissioning associated with units that are within 1/4 mile (1 mile for blasting) of occupied or unsurveyed suitable habitat for marbled murrelets will apply a daily timing restriction from 1 April - 15 September when work will be scheduled no earlier than 2 hours after sunrise and no later than 2 hours before sunset. An exception is made for areas associated with mainline haul route maintenance. It is recommended that these activities not occur 1 April - 5 August within 1/4 mile (1 mile for blasting) of occupied or unsurveyed suitable habitat for marbled murrelets where possible.

Road construction will incorporate design features to protect water quality. These BMPs (RMP ROD p. D3, D4) may include but are not limited to avoiding fragile or unstable areas, minimizing excavation and height of cuts, endhaul of waste material where appropriate and construction during the dry season.

All new construction will be ridgetop or near ridgetop on stable slopes and benches.

Any offsite movement of sediment from newly constructed roads and ditches near streams will be contained with silt fences or sediment entrapping blankets or straw bales. Such control measures would allow for the free passage of water without detention or plugging. These control structures and applications should receive frequent maintenance, and be removed at the completion of hauling, with sediment retained by the filters to be transported to an upland location to prevent subsequent delivery to aquatic resources.

All newly constructed dirt roads and landings will be seasonally maintained prior to winter rains if to be used the following year. Seasonal maintenance may include, but is not limited to, providing adequate water bars, mulching at a minimum of 2000 lbs. per acre using wood chips or straw and seeding with a district approved erosion control seed mix.

All road cuts and fills will be seeded with native grass, if seed is available. If none is available, then an approved BLM seed mix will be used.

All material overhanging the edges of landings will be pulled back.

Maintenance of the existing roads along haul routes would be accomplished during the life of the sale to minimize road drainage problems and possible road failures.

Stream crossing culvert replacement will be completed during the dry season.

When replacing an in-stream culvert, water will be pumped around culvert replacement sites.

All newly constructed roads will be decommissioned at the end of logging operations. Temporary roads with a gravel surface would be decommissioned within a year after logging operations are complete.

Waste area sites will be located on stable ground, as designated by the Authorized Officer. Such sites should be absent of movement indicators such as slump heads, scarps, deformed vegetation (pistol butted trees, tilting trees, etc.), sag ponds, and seeps and springs.

Locate waste areas at least 110 feet from annual streams and 220 feet from perennial streams.

Direct water in ditchlines and/or roadways away from the disposal site.

All newly constructed roads will be decommissioned when logging operations are completed.

All roads identified for closure will be decommissioned. All dirt surface roads will be scarified to a depth of at least six inches to allow grass seed to catch and remain on the road surface. Water bars will be constructed as per district standards.

All roads to be closed will have either the culverts pulled or water bars constructed to ensure pre-road hydrologic function and will be blocked to any motorized vehicle.

After road and landing construction is complete, all bare soil areas on road cuts, fills, and landing areas will be grass seeded with native grass seed or approved BLM mix and mulched. If landings are planted, plant with native conifer species appropriate to the site.

Project Design Features Rock Quarry Locations

Four existing rock quarries could be used to provide surface rock for roads within the project area: Water Tank Quarry T.26 S., R.10 W. Sec. 23; Buck Peak Quarry T.27 S., R.9 W., Sec. 10; Elk Wallow Quarry T.27 S., R.9 W., Sec. 14; and Burnt Mountain Quarry T.27 S., R.9 W., Sec. 24. Quarries will be used for sandstone base rock for roads. The rock would be quarried using a typical wall and bench method. This consists of removal of surface vegetation from areas immediately to be mined, removal of overburden into perimeter berms, drilling of shot holes into the resource rock, detonation of charges to fracture the rock structure, transfer of the shot rock to the crushing system, and transportation of the final rock product.

Blasting would not occur within 1 mile of known NSO nest sites 1 March - 30 September unless protocol surveys indicate owls are not present, that they are not nesting, or that young have dispersed. Other quarry activities within ¼ mile of known nest sites will not occur 1 March - 30 June at a minimum.

Blasting would not occur within 1 mile of occupied marbled murrelet sites 1 April - 15 September. Blasting would not occur within 1 mile of unsurveyed suitable marbled murrelet habitat 1 April - 5 August; in addition, projects will be scheduled no earlier than 2 hours after sunrise and no later than 2 hours before sunset from 6 August - 15 September.

Quarry activities other than blasting that create noise disturbance that are within ¼ mile of unsurveyed suitable marbled murrelet habitat will not occur 1 April - 5 August; in addition, projects will be scheduled no earlier than 2 hours after sunrise and no later than 2 hours before sunset from 6 August - 15 September.

Project Design Features for Fuels Management

Fuels management activities would include site preparation and hazardous fuels reduction.

Hazardous fuels reduction activities will consist of machine and/or hand piling of activity fuels, including landings, then covering and burning at a time of reduced fire danger.

Site preparation can consist of numerous activities including slashing, machine/hand piling and burning, swamper burning, broadcast burning, and chainsaw scalping.

All harvest and post-harvest activities will be in compliance with applicable Oregon State Fire Regulations. Disposal of slash through various burning methods would be conducted under the direct oversight of Bureau of Land Management personnel and will be in compliance with the State of Oregon Smoke Management Guidelines.

To facilitate hazard reduction and site preparation activities, directional falling away from all project area boundaries, mainline roads or roads not planned for closure or decommissioning, property lines, no-harvest buffers, and managed known site buffers for Survey & Manage species would be required.

Post harvest treatments for hazard reduction and site preparation may include: 1) the slashing of undesired and/or competitive vegetation, 2) machine and/or hand pile of slashed vegetation, logging residue, and landing pullback. Machine and/or hand piled slash, including landings, would then be covered with black plastic and burned in the following late fall/early winter.

Broadcast burning would be used for site preparation in selected areas, alder conversion sites and stand openings, and would be conducted under spring-like conditions. Hand constructed fire lines would be located on or near the unit boundaries. Complete (100%) mop up of burned areas will be required.

Swamper burning as a site preparation method, would be conducted during the fall/winter season. Undesired vegetation would be slashed immediately following the completion of yarding. Areas with heavier concentrations of slash and with fuels suitable as ignition points would be partially covered with black plastic. During the late fall and winter months those surrounding areas by throwing slash ½" to 6" in diameter into the burning areas. Additional chainsaw work such as cutting logging residue into pieces that can be easily handled, would be done at the time of burning to facilitate the swamper burning.

Chainsaw scalping as a site preparation method involves using chainsaws to slash through existing undesired and/or competitive vegetation and logging slash followed by the use of a hand tool to clear a specific planting site down to mineral soil.

Landing piles and concentrations from ground-based processor and cable operations located within the interior of the project areas and along roads designated for post-harvest closure or decommissioning, as an alternative to pile burning, could be broken up and scattered before equipment is removed from the site. Some of this material could be used to reintroduce organic material to natural road surfaces by scattering slash over the road.

It is recommended when possible, that units will not be burned from 1 March - 30 June within one mile of known northern spotted owl sites. It is also recommended when possible, that units will not be burned from 1 April - 5 August within 1 mile of occupied marbled murrelet sites or unsurveyed suitable habitat. If burning does take place during these time periods, try to avoid allowing heavy concentrations of smoke to linger in known sites.

Directional falling away from all project area boundaries, mainline roads or roads not planned for closure or decommissioning, property lines, Riparian Reserves, and managed known sites would be required.

Logging slash concentrations created from ground-based and cable operations can be reduced through piling and burning or breaking up and scattering. Either should be completed prior to the removal of equipment from the site.

If landing pullback is required, material should be placed on top of the existing landing. Also, pullback any material (dirt and wood) resulting from sweeping debris off the landing.

Landing piles resulting from ground-based and cable yarding operations need to be located a sufficient distance away from leave trees to minimize scorching when burning.

Burn piles will be located away from existing snags and down wood to prevent fire charring.

Hand or machine piling should be conducted after harvest operations are concluded on each unit.

Hand or machine pile all slash ½ inch to 4 inches in diameter.

Hand or machine pile within 75 to 150 feet of private property lines (depending on site conditions).

Hand or machine pile to within 20 feet each side of those roads within harvest areas not identified for closure or decommissioning after harvest.

Except along existing roads, machine piling would be limited to those units with slopes less than 35% and to periods when soil moisture is below 25%.

Cover slash piles with four millimeter black plastic and burn during the following late fall and winter months.

Consolidation of piles with a machine would be allowed to reduce the number of piles along paved or rock roads.

Roadside machine piling will be limited to dry weather periods.

Broadcast burning may be completed under spring like conditions if the following conditions occur: 1) the area to be broadcast burned has a defensible boundary, (keep within unit and out of Survey and Manage known site management areas), and 2) the area has sufficient access for crews, equipment and adequate nearby water resources for holding and mop up operations.

Construct hand fire lines on the exterior of unit boundaries. 100% mop up of burned areas will be required.

If swamper burning, locate ignition points in places that will minimize potential impacts to snags and coarse wood. "Swamped" slash residue should be thrown away from snags and coarse wood.

Project area with poor access to boundaries that are located in areas difficult to keep fire out of, and pose a high risk of escape, should be treated with alternative methods such as hand or machine piling.

Post harvest site preparation treatment would also include the slashing of undesired competitive brush species and the hand piling of slashed brush and logging residue from ½ inch small end to 4 inches on the large end. Handpiled brush would then be covered with black plastic and burned in the following late fall/early winter prior to planting season. Piles could be oriented throughout the stand to provide the best opportunity for achieving desired spacing or distribution of planted understory trees. The burn holes from the piles will provide a good micro-site for planting and promote survival of underplanted trees.

Project Design Features for Snag and Coarse Woody Material Creation

Up to three trees per acre will be identified for snag and down wood material in specified units to provide habitat for a variety of wildlife such as herptiles and small mammals. Existing decay class 1 and 2 down wood would be counted towards the prescribed levels for upland coarse wood material. For the in-stream levels, coarse woody material cut and left for logging corridors would be counted towards the total.

Snag creation methods would include chainsaw topping, girdling, blasting, or hand pile burning. Careful consideration and selection of candidate trees for snag creation is needed to allow for safety of the general public, contractor, and government personnel who might visit the site in future years. Existing snags will be retained in units where possible. Refer to Appendix D - Snag and Coarse Woody Debris Management for trees per acre and size class of snags to recruit for each unit. Snag recruitment will occur after yarding has been completed within the units. Damaged trees that are unintentionally created in the course of logging will be counted towards recruitment goals.

Snags will be created from conifer leave trees that rank among the middle third dbh size class in the stand so as to not take the dominant live trees. Snag creation would be postponed if the trees in this middle third dbh size class are smaller than 15 inches dbh. Trees selected to create snags will be conifer, greater than 15 inches dbh.

Snag creation would not occur within 100 feet of roads.

The minimum height for topping/girdling of conifers is 50 feet., and if possible, one live limb will be left on the tree. Tops and limbs generated from topping will be left on site.

Down wood recruitment will occur concurrently with or after harvest operations have been completed within the units.

All existing coarse woody material (class 1-5) will be retained in stands.

Project Design Features for In-Stream Restoration

In-stream projects would be located adjacent to a proposed thinning unit. The pulling over (lining) or cutting and felling of whole mature conifer trees into stream channels is an effective method of restoring old-growth material to fish bearing streams. “Key piece” sized logs would be placed in the stream channel to form complex jams. A “key” piece of in-stream old-growth material is identified by the Oregon Department of Fish & Wildlife as being greater than 24" dbh x 33' long, and by the National Marine Fisheries Service as being 24" dbh x 50' long in size. Douglas-fir is the preferred tree species, however, western red-cedar or western hemlock logs can also provide functional pieces. Key pieces of old-growth material in this size range are durable, long lasting, logs that provide for and maintain stream channel function and/or fish cover.

Flooding and debris flows in Tioga Creek and Burnt Creek can generate enough energy to transport logs downstream. In-stream restoration by means of log placement within Tioga and Burnt Creeks should be attempted with the largest logs size possible and in no case should logs be less than the National Marine Fisheries Service size recommendation for key pieces. Smaller logs can act as functioning structure in smaller streams such as Beaverslide Creek and upper West Fork Tioga Creek when placed with 1-2 key piece sized logs in small jams.

Logs for placement would come from trees cut from adjacent proposed thinning units, if the proper sized trees are available. Trees to be used as habitat logs for in-stream improvements, may need to be cut at lengths of 60 + feet. Logs could also be placed by helicopter or trucked and yarded into place, which ever is feasible.

Use approximately 125 trees for enhancement.

Table 1- In-stream Restoration Opportunities Within Tioga Creek Subwatershed

Location	Type	Description	Placement Method
Lower Burnt Creek Unit #14a	Log placement - all key piece sized	-5 jam sites with 4 Key logs per site -On/over existing boulder weir sites -Recommended size: 24" dbh X 40' long. If material not available, can go smaller	Helicopter or cable yard
Beaver Slide Creek Units # 12a, 12b	Log placement 1-2 key pieces with other logs added	-5 jam sites with 4-6 logs per site; -5 logs throughout 1999 project site. -Recommended size: 24" dbh X 32' long. If material not available, can go smaller.	Helicopter
Tioga Creek (Quarry to gaging station, including Burnt Creek mouth) Unit # 14c	Log placement - all key piece sized	-10 jam sites with 5+ Key logs per site -On existing boulder weir sites -Minimum size: 24" dbh X 60' long	Helicopter or cable yard
West Fork Tioga Creek Unit # 13b	Log placement 1-2 key pieces with other logs added	-5 jam sites with 5 logs per site -Recommended size: 24" dbh X 32' long. If material not available, can go smaller.	Helicopter or cable yard

Apply Best Management Practices to reduce or eliminate erosion and sediment delivery to the drainage network.

Use of heavy equipment in and near waterways requires the development and submission of Spill Prevention, Control and Countermeasure Plans for any project resulting from this EA. Contractors will also be required to furnish and keep spill containment kits on site. Specifications for these requirements have been developed and will be included in contracts or task orders. The District Riparian Spill Plan is to be followed in the event of an occurrence. (References: 40 CFR 100-149, 260-299, and 300-399. Oregon Revised Statutes Chapters 466 and 468; Oregon Administrative Rules 340-108 (Department of Environmental Quality Spill and Cleanup); OAR 629-57-3600 (Oregon Forest Practices)).

Project Design Features for Botany

Surveys will be completed as necessary and in accordance with the Final Environmental Impact Statement for Amendment to the Survey and Manage, Protection Buffer, and other Mitigating Measures Standards and Guidelines and its Record of Decision

Port-Orford-Cedar

There is no POC within any of the harvest units or any POC along the haul routes which would be impacted by operation of the timber sale or any other reasonably foreseeable timber management activity contained in the Coos Bay District Resource Management Plan.

Project Design Features for Noxious Weeds

All tracked and wheeled vehicles will be washed, including belly pans, prior to entering BLM lands. Vehicles are required to stay within the road rights-of-way, except those specifically designated to operate within units (ex. mechanical harvesters).

Noxious weeds on existing roads and landings, or proposed new construction, will be treated manually, mechanically, or chemically prior to road construction or harvest activities. Treatments will allow for safe vehicle use and limit contact of vehicles with weeds and seeds. Where possible retain shade and minimize disturbing existing seedbeds and soil.

BLM shall ask for permission from private road owners to treat the noxious weeds on their road rights-of-way, under the conditions of use request.

Project Design Features for the Northern Spotted Owl

Proposed activities, such as tree felling, yarding, snag creation, down wood creation, and in-stream projects, will not occur within ¼ mile of any northern spotted owl nest site or activity center of all known pairs and resident singles between 1 March - 30 June at a minimum (except for that associated with mainline haul route maintenance). BLM wildlife biologists have the option to extend the restricted season during the year of harvest until September 30, based on site-specific knowledge, such as a late nesting attempt. This Project Design feature may be waived in a particular year if nesting or reproductive success surveys reveal that spotted owls are non-nesting or that no young are present that year. Waivers are valid only until 1 March of the following year. Previously known sites/activity centers are assumed occupied unless surveys indicate otherwise.

A wildlife biologist may modify the boundary of the ¼ mile area based on topographic breaks or other site-specific information

Blasting would not occur within 1 mile of known sites, from 1 March - 30 September, unless protocol surveys indicate owls are not present, that they are not nesting, or that young have dispersed.

Project Design Features for Marbled Murrelet

Harvest activities, snag creation, down wood creation, and in-stream projects within ¼ mile of unsurveyed suitable habitat, would not occur 1 April - 5 August. In addition, operations would be confined to between two hours after sunrise to two hours before sunset (Daily Operating Restrictions) 6 August - 15 September.

Blasting would not occur 1 April through 5 August within 1 mile of unsurveyed suitable habitat. Daily operating restrictions for projects located within 1 mile of unsurveyed suitable habitat would apply from 6 August through 15 September. Projects will be scheduled no earlier than two hours after sunrise and no later than two hours before sunset.

The Authorized Officer has the option to adjust the restricted season and zone based on site-specific conditions such activity levels at the site, topography, or the type of impact.

Recommended to delay projects within ¼ mile of suitable habitat until after 15 September where possible.

Recommended to concentrate disturbance activities spatially and temporally (get in and get out, in as small an area as possible; avoid spreading the impacts over time and space).

Project Design Features for Special Status Species

If any threatened or endangered species are found in the sale units, and it is determined that operations may affect these species, operations may be discontinued until consultation for the species is completed.

Prior to advertising of timber sale or procurement contracts, required surveys will be done to protocol and management guidelines will be implemented.

If Special Status species are found and require a protection buffer, an appropriate buffer will be identified and reserved from cutting and yarding through prior to the initiation of harvest activities.

Incorporate all applicable Project Design Features, including seasonal or daily timing restrictions, and Terms and Conditions, from the U.S. National Marine Fisheries and U.S. Fish & Wildlife Service Biological Opinions.

Project Design Features for Recreation/Cultural

Reduce slash adjacent to unimproved roadside hunting camps. Keep access to the camps open.

Native American Grave Protection and Repatriation Act (43 CFR Part 10; IM OR97-052) notification requirements will be followed.

If any important cultural materials are encountered during the project, all work in the vicinity will stop and the District Archaeologist will be notified at once.

Project Design Features for Solid and Hazardous Waste

Contracts will contain provisions for compliance with the State of Oregon Department of Environmental Quality (ODEQ 1998) and Oregon Department of Forestry Forest Practices (ODF 1998) guidelines for spill response and containment. Site monitoring for solid and hazardous waste will be performed during all operations in conjunction with normal contract administration. Any spills or releases resulting from operations shall be subject to the Coos Bay District Hazardous Materials Management Contingency Plan (USDI BLM, 1997). Hazardous material reportable quantities are defined in ORS Chapter 466.1, Hazardous Waste and Hazardous Materials 466.605 to 466.680.

Alternatives Identified but Eliminated from further Analysis

Thinning with no removal of cut trees

This alternative was rejected because leaving that amount of coarse woody material on the ground would create long term heavy fuel loads, would increase the risk of insect infestations (Hostetler and Ross, April, 1996) and would suppress understory development. In addition, this would not be an economically viable option since there is no funding source to accomplish this work.

No Thinning within Riparian Reserves

This action would be inconsistent with the *Record of Decision* for the *Aquatic Conservation Strategy Objectives* and would not attain the long-term goals of the *South Coast-Northern Late-Successional Reserve Assessment*. An interdisciplinary team examined the entire subwatershed and identified areas that would have the best opportunities in relation to current ecological windows.

CH. 3 - DESCRIPTION OF THE AFFECTED ENVIRONMENT

Introduction

This section describes the environmental components that could be affected by the Proposed Action, if implemented. This section does not address the environmental effects or consequences, but rather serves as the baseline for the comparisons in Chapter 4 - Environmental Consequences.

A review of the existing environment shows that the following list of critical elements of the Human environment are either not present or would not be affected by these projects; therefore they will not be addressed in this EA: Air Quality, Farmland (Prairie/Unique), Wild and Scenic Rivers, and Wilderness.

The proposed thinning and alder conversion units proposed under this environmental assessment, are located within the Tioga Creek Subwatershed (6th field), a Tier 1 key watershed, which is part of the South Fork Coos 5th field watershed. Minor portions of the proposed project overlap into the Brummit Creek Subwatershed that is part of the East Fork Coquille 5th field watershed. Elevation of the proposed project area is within the range of 500 - 2,700 feet.

The Tioga Creek Subwatershed is comprised of four drainages; Lower Tioga Creek, Middle Tioga Creek, Burnt Creek, and Upper Tioga Creek. The drainage area is approximately 39 mi². The confluence of Tioga Creek with the Williams River forms the hydrologic terminus of this area. At this point the two rivers combine to form the South Fork Coos River and eventually enter Coos Bay and the Pacific Ocean to the west.

Table 2 - Tioga Creek Subwatershed Acreage Table

Tioga Creek Subwatershed - Density Management Acreage Table			
Total Acres Subwatershed:			24,654
Total Acres BLM Ownership:		15,778 (64%)	
Drainages:			
Burnt Creek			2,367
Lower Tioga Creek			5,170
Middle Tioga Creek			3,554
Upper Tioga Creek			4,687
Total Acres LSR		12,716 (81%)	
within Riparian Reserve		8,308	
Total Acres GFMA & Connectivity		3,062 (19%)	
within Riparian Reserve		2,317	
Total Acres Proposed Project (Umpqua RA)	2,794 (18%)		
within Riparian Reserve		1,669	
Total Acres Proposed Project E. Fork Coquille Subwatershed	160		

Vegetation

Overstory

The Tioga Creek subwatershed is within the western hemlock (*Tsuga heterophylla*) zone described by Franklin and Dymess (1973; pp 70-88). The common conifer trees are Douglas fir, western hemlock and western red cedar. The common hardwood trees are red alder, bigleaf maple, and Oregon myrtle. Current vegetation patterns are due primarily to timber harvest practices, road building, and natural fires.

Based on Landsat data from the summer of 1993 and an acreage breakdown in the South Fork Coos River Watershed Analysis, the Tioga Subwatershed, including private property, is comprised of the following vegetative land class percentages:

Water, new clearcut, young plantations, non-forest	10.2%
Conifer stands	80.5%
Hardwood stands	8.3%
Mixed stands	1.0%

Based on data from the South Fork Coos River Watershed Analysis, the forest age classes for the Tioga Creek subwatershed are as follows:

Table 3 - Age Classes within Tioga Creek Watershed

	Age Class Distribution									
	Early Seral	Mid Seral		Late Seral and Old-growth			NF	BLM ac.	BLM ac. With 80+	Percent ac. With 80 yrs.+
	0-30	31-60	61-80	81-160	161-200	201+				
Total Tioga Creek Subwatershed Acres	5,480	2,878	864	2,400	0	4,111	46	15,778	7,375	46.7%
Total Project Acres	1,035	1,640	460	0	0	0	0			

NF = Non-Forest

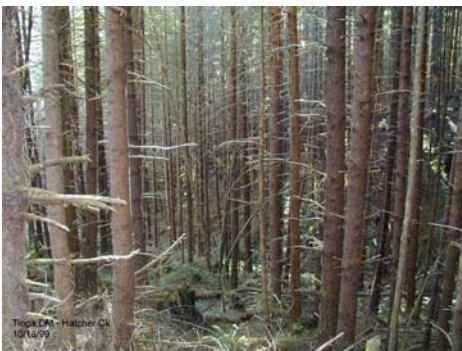
Ages calculated from District FOI. See Current Conditions Table for actual stand age. Also see Appendix A for a map displaying the Forest Age Classes and Density Management Units

Density Management Units

Data from field stand exams and Forest Operations Inventory (FOI) records were used to compile the Table 6 - Current Conditions shown below. Most of these second growth stands have been intensively managed for timber production and have received silvicultural treatments such as pre-commercial thinning, brush control, and fertilization to enhance growth and vigor. Some stands are a result of burns, reburns, and natural regeneration. A history of the Tioga Creek Subwatershed can be found in the South Fork Coos Watershed Analysis: Tioga Fire History Appendix.

According to Forest Operations Inventory records, approximately 249 acres or 8% of the stands in this density management project have been identified as candidates for red alder conversion. These stands are primarily red alder with scattered bigleaf maple, myrtle, and conifers. The alder stands are the result of past logging where conifer regeneration was not well established.

The age of the stands being analyzed range from approximately 29 to 72 years of age with an average of 40 years. The average diameter at breast height is 13 inches. The average number of trees per acre ranges from 140 to 720 with an average for all stands of 269.



The relative density of the proposed units ranges from 45 to 93 with an average of 62. Relative density expresses the density of the trees relative to a theoretical maximum density. Relative density increases for a given number of trees per acre as stem diameters increase. Relative density decreases for a given stem diameter if the number of trees per acre decrease. A relative density of 55 or higher indicates a stand is in the suppression induced mortality zone. A relative density of 35 is considered full site occupancy. A site with a relative density 25 to 35 is considered less than fully occupied and capable of understory development (Journal of Forestry, August 1997). The stands being considered are overstocked and have a Relative Density, either in or approaching the suppression induced mortality phase.

**Figure 4 - Hatcher Creek Unit 5a
Relative Density = 69**

Table 4 - Current Stand Conditions

Unit #	T-R-S	Stand Type**	GIS acres	Age***	Ave. ht.	Ave. dia.	Ave.tpa	R.D.
1	26-10-13	D3-=1966	16	26	77	10	395	66
2	26-10-13	D3-=1967	8	26	77	10	395	66
3a	26-9-17	PL_D2-=1970	32	27	74	11	308	58
3b	26-9-17	D4-=1920	11	57	81	14	321	79
4	26-9-17	PL_D3=1960	39	38	82	11	672	89
5a	26-9-18,19	D3-=1950	188	41	95	13	260	63
5b	26-10-13,24	D3-=1958	200	33	91	13	209	54
5c	26-9-19	PL_D2-=1969	42	23	71	10	250	52
6a	26-10-23	D3-=1950	60	35	100	15	163	49
6a1	26-10-23	S_D3-=1967	50	28	69	12	234	49
6a2	26-10-23	D3-RA=1950	4	33	87	11	260	51
6b	26-10-23	SD2-=1967	37	30	63	10	343	62
6c	26-10-23	PL D2=1969	23	26	56	8	572	75
6d	26-10-23	PL D2-=1974	32	20	66	10	345	62
8	26-9-21	PL_D2-=1969	105	29	79	11	280	52
10	26-10-25	PL_D2-=1968	99	36	87	13	206	49
11	26-10-35	S_D3-=1967	32	30	73	8	720	93
12a	26-10-35	PL_D2-=1970	26	24	69	10	319	68
12b	26-10-35	PL_D2-=1950	48	58	90	15	200	63
13a	26-10-35	HC_RA2D-1969	10	33	52	15	216	68
13b	26-10-35	PL_D2-=1969	86	35	80	12	293	69
14a	26-9-32	D4-=1910	30	61	107	14	247	70
14b	26-9-31	D3-=1960	132	50	82	13	257	58
14c	26-9-31	HC_RA3-=1950	100	37	103	16	211	55
15a	26-9-33	PL_D2-=1970	55	24	64	10	244	45
15b	26-9-33	D3=1950	62	38	86	13	182	49
15d	27-9-4	D3-=1950	151	37	95	14	229	62
15e	27-9-24	PL_D3-=1962	26	25	69	9	432	59
15f	27-9-24	D3-=1959	50	39	97	15	175	55
15g	27-9-9	PL_D3=1966	74	34	87	13	210	51
15h	27-9-9	HC_D2RA-=1971	66	29	No stand exam information taken.			
16	27-9-9	S_D3-=1966	59	26	64	10	320	56
17	27-10-14	H4-=1930	13	66	84	11	303	85
18	27-10-13	D4-=1920	165	67	123	18	140	57
20	27-9-18	D4-=1930	101	64	125	19	175	56
21	27-9-18	D4-=1910	149	62	90	14	227	62
22b	27-9-20	N_D3-=1965	59	51	85	13	170	46
22c	27-9-21	S_D3-=1967	103	33	79	14	260	63
23	27-9-21	S_D3-=1960	48	32	72	10	360	64
24	27-9-5	D4-=1910	116	68	123	18	124	54
25	27-9-5	D4-=1910	48	53	120	18	150	64
26	27-10-1	N_D3=1957	55	56	107	14	170	78
27	27-10-1	HC_HD3-=1960	47	40	77	13	214	67
		Total	2857					
		Average	130	39	85	13	280	62

** Taken from the District's Forest Operations Inventory

*** Bored measurements taken at breast height- add 5 years for stand age

Alder Conversion

These forest stands or portions of stands as listed in Table 5 - Alder Conversion Units have been identified for conversion to conifer. Stands that have an alder component and historically had no conifer component will not be converted

Table 5- Alder Conversion Units

Unit #	Stand Vegetation Components
3a, 6a	Sword fern, evergreen huckleberry, vine maple understory with scattered western hemlock under varied size patches of red alder overstory amongst a young overstocked conifer stand.
10, 11	Salmonberry, Sword fern, trailing blackberry understory with scattered red alder patches on the north end of the unit; transitions to an alder dominated overstory
13a	Salmonberry, Sword fern, red huckleberry understory; conifer/alder mix above upper road with an alder overstory between the roads.
12a,12b, 13b	Sword fern, salmonberry understory with patches of red alder in the mixed conifer understory.
14c	Salmonberry, Sword fern, vine maple understory with red alder overstory and scattered myrtle.
15b	Sword fern understory with scattered red alder patches in overstory of young conifer.
15e	Sword fern, salmonberry understory with both scattered red alder clumps in the overstory.
15h, 27	Sword fern, salmonberry understory with red alder overstory.

Wildlife

Special Status Wildlife Species

The South Fork Coos Watershed Analysis provides a general description of wildlife species and habitat conditions found within the subwatershed. Site-specific key habitat features, wildlife species of concern, and documented wildlife sightings are provided below.

Northern Spotted Owl

There are 13 northern spotted owl core sites within the Tioga Subwatershed (Table WL-1, wildlife analysis file). A portion of the home range of an additional three owls is within the watershed. All of the owl sites fall below the 40 percent Suitable Habitat threshold set by the U.S. Fish and Wildlife Service.

There are 9,730 acres of dispersal habitat classified as stands 40 years of age or older in the subwatershed. Dispersal habitat within the subwatershed is important for connectivity to other portions of LSR #261. All proposed treatments in dispersal habitat would maintain an average canopy closure of at least 60 percent in accordance with the Late-Successional Reserve Assessment (LSRA p. 71).

A portion of 7 of the units are within 0.25 miles of owl site center. None of the proposed units are within the 100-acre owl core areas. None of the units would remove suitable habitat. All of the proposed units are within NSO Critical Habitat Unit OR-60.

Marbled Murrelet

There are no known marbled murrelet nest sites in the subwatershed. There are approximately 2,714 acres of suitable murrelet habitat in the LSR/RR LUA in the subwatershed. The proposed units are all within Critical Habitat Unit OR-06-b. Table WL-4 in the wildlife analysis file lists the proposed units that are within 0.25 miles of suitable marbled murrelet habitat.

Other Special Status Species

There are no other known threatened or endangered species nest sites or activity centers within the proposed sale areas or the immediate vicinity. However, the following other Special Status Species may be present in the project area.

Amphibians and Reptiles

Surveys were not conducted for these species, but the clouded salamander and red-legged frog have been documented in the subwatershed. Special Status Species associated with the aquatic system include: southern torrent salamander, red-legged frog, foothill yellow-legged frog, and tailed frog. Western toads are associated with forest or brush areas, and use shallow, slow water for breeding. Decayed down logs (preferably with bark intact) provide habitat for the clouded salamander. Though no suitable habitat was discovered in the subwatershed, the area is within the range of the western pond turtle. The units are most likely out of the range of the common kingsnake, but the sharptail snake may be present.

Mammals

The western gray squirrel and white-footed vole may be present, though neither species has been documented. Due to the young age of the stands proposed for treatment, it is unlikely that the American marten or Pacific fisher currently inhabit the proposed sale units. The management area is outside the known range of the ringtail. Bat species that could occur in the area and listed as Special Status Species are: Yuma myotis, long-legged myotis, fringed myotis, long-eared myotis, silver-haired bat, and Pacific western big-eared bat (BLM Informational Bulletin No.-OR-2000-92).

Birds

Due to the relatively young age of the stands, and the lack of large rivers or cliff sites, there is no suitable habitat for bald eagles or peregrine falcons in the proposed sale units. The subwatershed likely provides habitat for pileated woodpeckers and northern pygmy owls. Neither of these species use the closed-sapling-pole-sawtimber stands as primary habitat, but could use it for secondary feeding habitat (Appendix 6, Brown 1985). The western bluebird and Allen's hummingbird could occur in the subwatershed, but do not use this type of un-thinned forest (Appendix 6, Brown 1985). A nesting pair of Cooper's hawks has been documented in the Matrix portion of the Tioga Creek Subwatershed. Though not a Special Status species, nests of Cooper's hawks receive a buffer according to the Coos Bay District Resource Management Plan (RMP ROD p. 28)

Survey and Manage Wildlife Species

Field surveys and corresponding management of known sites will conform with the Final Supplemental Environmental Impact Statement For Amendment to the Survey and Manage, Protection Buffer, and Other Mitigating Measures (S&M FSEIS) and its ROD and Standards and Guidelines

Red tree voles are likely to occur in the project area. Nests have been discovered in the proposed Matrix commercial thinning units adjacent to the project area. Surveys for the red tree vole will be completed as required by survey protocol and the S&M ROD. Upon completion of surveys, high priority sites will be managed according to management guidelines.

A portion of the management area is at the northernmost edge of a 25-mile survey range from an established known Del Norte salamander site. There are no known Del Norte salamander sites in the project area.

There are known *megomphix hemphilli* sites within the project area that will be managed according to management guidelines in the Survey and Manage ROD.

No caves, abandoned buildings, or wooden bridges were found that could be providing bat roost sites and would require additional protection under the Survey and Manage ROD. Species that would use these structures and that could occur in the area are fringed myotis, long-eared myotis, long-legged myotis, silver-haired bat, and Pacific western big-eared bat. The thick bark of older trees and bark and cavities in snags within the units could be providing habitat for the ten bat species that can be found in the Western Oregon Coast Range (Csuti et al. 1997). The small cracks in the quarry stone could also provide roosting habitat, however, there are no large openings or caves at the quarries that would be providing habitat.

Pre-harvest protocol surveys for great grey owls are not required on the Coos Bay District. In addition, the sale units do not meet the suitable habitat characteristics as the sales are not at elevations above 3,000 feet, and there are no natural meadows that are greater than 10 acres within 1,000 feet of the units.

Special Habitats

Special habitats that are used by wildlife include cliffs, talus, wet meadows, bogs and other unique areas. Seeps and springs will be buffered during the marking of the stands. No significant special habitat features were found that would require additional buffering.

Riparian Reserves Species

The following Riparian Reserve Species were listed in the South Fork Coos Watershed Analysis as key species to consider when analyzing wildlife habitat needs and the attainment of ACS objectives: Oregon megalophis, blue-grey tail-dropper, papillose tail-dropper, southern torrent salamander, Del Norte salamander, tailed frog, white-footed vole, and bald eagle. The tail droppers could occur in the management area but they are no longer categorized as Survey and Manage species. The Del Norte salamander is unlikely to occur within the project area since no suitable habitat has been observed. The other species have been discussed above. Approximately 60 percent of the treatment acres are also in the Riparian Reserve LUA. The actual riparian zone, which is much smaller than the Riparian Reserve, will be buffered in the units.

General Habitat and Associated Wildlife

The Final Coos Bay District Proposed Resource Management Plan/Environmental Impact Statement contains a complete list of wildlife species known to occur on the Coos Bay District (FRMP, Appendix T), and the South Fork Coos Watershed Analysis (Wildlife Appendix) lists species known or suspected in the project area. The treatment units in general are classified as temperate coniferous forest plant communities with a closed-sapling-pole-sawtimber stand condition (Brown 1985, Appendix 6.). The subwatershed contains approximately 3,742 acres of BLM land in this condition or 24% of the BLM ownership. Many wildlife species use the current stands, but most of these species use a broad range of seral stages compared to wildlife that depend on late-successional forest habitat. Brown lists five bird species that use this stand condition as primary habitat for breeding, feeding, and resting: sharp-shinned hawk, golden-crowned kinglet, Swainson's thrush, pine siskin, and evening grosbeak (Brown 1985, Appendix 8). These birds use other stand conditions as primary habitat as well. There are 35 other bird species that use this stand condition as secondary habitat.

Neotropical migratory birds that may be present in the watershed are listed in the Final RMP (FRMP, Appendix T). Neotropical migratory birds nest at various levels of the forest stands including ground, shrub and canopy level. Most of the units do not have a shrub layer and thus do not provide sites for ground or shrub nesters.

Brown also lists mammals and amphibians that use the closed-sapling-pole-sawtimber stand condition. (Brown 1985, Appendix 8.) Mammals that use this stand condition as primary habitat for breeding, feeding and resting include masked shrew, Trowbridge shrew, shrew-mole, Townsend's chipmunk, Douglas squirrel, bushy-tailed woodrat, red tree vole, western red-backed vole, and porcupine. Other mammals that use the stands as primary habitat for either breeding, feeding and resting but not all three categories are: black bear, raccoon, short-tailed weasel, Roosevelt elk, and black-tailed deer. Five species of salamanders and three frog species also use closed sapling-pole-sawtimber stands as primary habitat, but use other stand conditions as well.

Roosevelt elk and black-tailed deer trails, bedding sites, and scat are located throughout all the units. Most of the units have very little understory vegetation, and thus provide low amounts of forage for big game; the vegetation that is present has been severely browsed in most cases. The units are providing thermal and hiding cover.

Current snag levels are analyzed in Appendix D - Snag and Coarse Woody Debris Management. Snags provide breeding habitat for 76 wildlife species and feeding habitat for 19 species (Brown 1985, Appendix 13). Special Status or Survey and Manage species that use snags include: bald eagle, northern spotted owl, northern pygmy owl, pileated woodpecker, purple martin, western bluebird, silver-haired bat, fringed myotis, long-eared bat, long-legged myotis, American marten, and Pacific fisher (FRMP, Appendix T).

For this area, the primary cavity nesters are the red-breasted sapsucker, red-breasted nuthatch, northern flicker, and downy, hairy, and pileated woodpecker. The target for maintaining a 100 percent population level of primary cavity nesters in this area is 3.83 snags per acre (Marcot 1991). The primary excavator species have minimum snag diameters and stage of decay requirements that must be met in conjunction with total numbers of snags on the landscape. In general, cavity nesters can use snags in larger dbh classes, but they cannot use snags below their minimum dbh requirement. The smaller snags do, however, provide foraging habitat. Refer to the Snag and Coarse Wood Debris Management in Appendix D for more detailed information.

Refer to the Snag and Coarse Wood Debris Management Appendix D for an analysis of current down wood levels and background information from the LSR Assessment. Appendix 20 of Brown (1985) contains a detailed list of species that use down logs as either a

preferred habitat component, or a commonly used habitat component. Habitat components are divided into cover, feeding, breeding, and resting/other and down wood is divided into decay classes.

Fisheries and Aquatic Habitats

The proposed density management units of this proposed project are widely distributed across the Tioga Creek subwatershed. They range in elevation from 540 to over 2,600 feet and cover channel habitat from the headwall (Rosgen A Type) to the lower mainstem (Rosgen C Type) near the confluence with Williams River.

Two streams in the subwatershed are on the Oregon Department of Environmental Quality's 1998 303(d) list of water quality limited streams. Tioga Creek and Burnt Creek are both listed from mouth to headwaters for water temperature. The water temperature standard was exceeded for both streams through monitoring of the lower reaches where there was less canopy cover over stream channels. Spot checks of water temperature in the middle to upper reaches of both streams indicate that the temperature is consistently in the range of middle to lower 50's. Further temperature monitoring in lower Tioga and Burnt Creeks would help define the specific upstream extent of water temperature limited reaches.

Fish Species of Concern

Four important anadromous fish species are present in Tioga Creek. Oregon Coast Coho salmon (*Oncorhynchus kisutch*) is federally listed as threatened. Oregon Coast winter steelhead trout (*Oncorhynchus mykiss*) is classified as a "candidate" species by the National Marine Fisheries Service. Oregon Coast cutthroat trout (*Oncorhynchus clarkii clarkii*) and fall chinook (*Oncorhynchus tshawytscha*), are also present. The Millicoma longnose dace (*Rhinichthys cataractae ssp.*), a State of Oregon sensitive species, is found in the lower portions of Tioga Creek and into the Coos River. The Pacific lamprey (*Lampetra tridentata*) is included on the State of Oregon vulnerable species list. In addition, resident non-anadromous lamprey inhabit Tioga Creek and its tributaries.

Aquatic Habitat Features

The quality and quantity of stream habitat can be directly related to stream channel complexity and relatively clean water. High quality aquatic habitat results from in-stream features such as boulders and coarse woody material (CWM) well distributed throughout the channel and riparian zone. In addition, high quality cool water and clean substrate greatly contribute to aquatic habitat. Where large logs are found in stream channels in these units, they provide aquatic habitat features most associated with proper functioning condition. Most of the existing large pieces of CWM are relics of past logging. These logs are generally class 3 and 4 and have a limited life as stable habitat structures. They contribute to channel stability although many reaches of perennial stream in these units are downcut. Aquatic and riparian habitat surveys have not been performed on most of the 1st to 3rd order ephemeral, intermittent and perennial streams within units. What is known comes from past fish distribution surveys in the basin and field visits.

Tioga Creek subwatershed is steep, rugged, deeply dissected and heavily forested. The drainage pattern is dendritic and has a density of approximately 8.0 stream miles/square mile which includes the mainstem of Tioga Creek and 13 major tributaries (4th order or higher). There are 237 miles of first and second order streams, 56 miles of third and fourth order streams, and 18.5 miles of fifth and sixth order streams. Aquatic habitat features, such as coarse woody material and channel substrate are delivered to the lower stream channels and become habitat features primarily through hillslope processes. These hillslope processes are such a major force in the formation and control of in-channel and aquatic habitat features and therefore fish habitat, that it is important to include them in this description.

The entire Tioga Creek subwatershed lies on the Tyee geologic formation. The areas with high potential for land failures that result in the delivery of wood and substrate to channels are most of the steep north facing slopes. They retain moisture later in the year and therefore tend to weather more readily. Also, hillsides that parallel the strike of the bedding planes and where the steepness of the slopes exceeds the bedding plane dipping angle are prone to failure. Many of the slope failures in this vicinity are related to ground disturbing activities on sites where the slope exceeds the angle of the out dipping bedding planes. Hillslope processes common to this watershed come in the form of soil creep, debris torrents, rotational slumps, earth flows, debris avalanches, and rock falls. Any of the catastrophic failure types can contribute large volumes of sediment and other larger material into the surface drainage system of this watershed over a very short period of time. First to third order tributaries are generally high gradient streams that are periodically active in providing large wood and substrate material to the higher order, generally fish bearing tributaries. The more erodible members of the Tyee formation weather to form waterfalls and long, steep cascades that occur throughout the landscape. Many of these falls and cascades are natural blocks to upstream fish migration. These sites function as collecting points for large wood as it is transported downstream and as sites where natural log jams form.

Hillslope processes are vital to providing long lasting durable coarse woody material to the main stem Tioga Creek and its larger tributaries. A very important component of excellent fish habitat in the Tioga Creek drainage is large wood accumulations. This coarse woody material accumulates in stream channels creating a diversity of aquatic habitat features. Much of this material originates from the upper areas of tributary streams and enters Tioga Creek through episodic landslides or other hillslope processes. Individual whole trees are more commonly recruited as they fall to the channel from within the riparian zones. If large tree recruitment is to occur, large trees are required to be positioned across the landscape at sites capable of contributing to landslides as they happen. Large wood controls channel morphology, sediment and water routing and provides structure and complexity to the channel. Large wood provides habitat for numerous aquatic and terrestrial organisms in both large and small stream channels. Many old aquatic habitat surveys made note of large logjams. The survey notes indicate that the watershed above the junction of the West Fork Tioga Creek held nearly all of these jams. From this junction to the mouth, Tioga Creek and tributaries had adjacent road systems and were salvaged or cleared of coarse woody material. Most of the largest jams were found at the junctions of tributary streams as a result of past hillslope processes. These jams have since been cleared to increase access for anadromous fish further reducing in-stream habitat.

Timber sales from the late 1960's to the early 1980's were reviewed for evidence of sale related stream cleaning as an exercise for the watershed analysis. Thirty timber sale records were found that showed "debris" was removed under contract from approximately 107 reaches totaling over 17 miles of upper tributary stream channels in the subwatershed, including some fish bearing streams. Debris removal contracts at that time were also used for removing channel obstructions (log jams) to gain anadromous fish access to uninhabited upstream reaches. Documentation suggests that this likely occurred over approximately 8 miles of Tioga Creek and major tributaries. Up until approximately the late 80's to early 90's, it was a common practice to salvage merchantable logs that were within view and reach of the forest road system. Roads parallel many miles of the higher order streams in the subwatershed, including lower and middle Tioga Creek, West Fork Tioga Creek, Shotgun Creek, Hatcher Creek, Beaver Slide Creek, Guard Camp Creek, and a short reach of lower Burnt Creek. Conservatively assuming that no other streams were cleaned through road salvage in the subwatershed, and that any particular reach was only cleaned once over time, an additional 16 miles of stream habitat may have been cleared of coarse woody material. An approximate total of 41 miles of stream channel may have been impacted by stream cleaning and presently may not be properly functioning. Other undocumented stream cleaning likely occurred, especially on private land.

Many Tioga Creek tributary streams are deficient in large wood in the stream channel and riparian zones. These stream channels and riparian zones are not in a properly functioning condition. A 2000 habitat survey of Tioga Creek shows that a cleaned and salvaged reach adjacent to a road had a large down wood volume of 4.3 m³ per 100m of channel (<20 m³ per 100m is considered poor using Oregon Department of Fish & Wildlife benchmark values). This compares with an upper basin roadless reach never known to be cleaned that contained a large down wood volume of 121.5 m³ per 100m of channel (>30 m³ per 100m is considered good using Oregon Department of Fish & Wildlife benchmark values).

Historically, approximately 8 miles of Tioga Creek, and up to four tributary miles were accessible and had suitable spawning and rearing habitat for chinook and coho salmon, and steelhead trout. Resident cutthroat trout are present in many perennial streams including streams above some barriers to anadromous passage. Sea-run and fluvial Oregon Coast cutthroat trout have a similar distribution as coho and steelhead. Three barriers (natural falls/cascades) to anadromous fish passage were bypassed in the mid-1960's on Tioga Creek. These bypasses increased the upstream access for chinook, coho, steelhead, and sea-run cutthroat trout by over 5 miles. Presently, natural barriers on Tioga Creek within Sections 17 and 21 limit upstream anadromous fish access. Most major tributaries to Tioga Creek contain coho and steelhead in limited sections of their lower reaches. These tributary streams are on the Tyee formation and steep cascades or falls limit upstream anadromous access.

Harvest units are located across the landscape of Tioga Creek. The Riparian Reserves of some streams that contain coho salmon and steelhead trout are contained within several proposed units (Units 4, 8, 10, 12a&b, 13b, 14a&b&c, 18, 24, and 26).

Most units contain 1st to 3rd order non-fish bearing streams that are positioned well above coho or steelhead bearing streams. These small tributary streams range from 0.25 miles to over 2.0 miles above coho or steelhead bearing streams.

Aquatic and Fisheries Habitat Management

From 1944 to 1957, the flows of Tioga Creek were regulated by a splash dam located on the South Fork of the Coos River just below the confluence. The dam had a head of approximately 30 feet and backed water up into the lower half mile of Tioga Creek. The operations of this dam all but halted access of anadromous fish species to Tioga Creek during this period. Road building, timber harvest, and stream clearing were other activities that had negative impacts on aquatic habitat and water quality. Over the years, approximately 24 miles of Tioga Creek and major tributaries were cleaned of logging debris jams and natural log accumulations. The removal of large wood and other channel constraints resulted in channels down-cutting and becoming wider. Much of the original

stored gravel in the river, associated with coarse woody material, was flushed out of the system following salvaging of merchantable wood from the channel and stream cleaning intended to improve fish passage. Loss of this coarse woody material eliminated spawning and rearing habitats as well as overhead cover and macro-invertebrate habitats. Future sources of large woody debris were also lost when mature trees were removed from upland areas adjacent to riparian zones. Removal of large trees from headwalls has resulted in a loss of potential large woody debris.

It has been recognized that in-channel habitat loss is a significant factor in the reduced production and survival of aquatic organisms and fish life in Tioga Creek subwatershed. Since the Tioga splash dam ended operation on the South Fork Coos River in September 1957, and stream cleaning was significantly decreased in the mid-1980's, there has been a concerted effort by the Bureau of Land Management, Oregon Department of Fish & Wildlife, and local private timber companies to restore anadromous fish runs and improve in-stream habitat in the Tioga Creek Subwatershed. Since 1977 the Bureau of Land Management has installed more than 100 in-channel structures over approximately 3.5 miles of Tioga Creek and tributaries to function as various in-stream habitat features. These structures have been successful in dissipating stream energy, collecting channel substrate, creating plunge and backwater pool habitats, and provide complex in-stream cover. Other habitat restoration opportunities on private land exist in the watershed. Recently, the Coos River Watershed Council, together with Oregon Department of Fish & Wildlife, have begun habitat improvement efforts on stream reaches belonging to private timber company streams within the watershed. Additional miles of in-stream habitat structures have included boulder weirs, boulder clusters, and coarse woody material (large logs) placement. Existing fish passage culverts have already been upgraded within the Tioga Creek Subwatershed through previously completed projects.

These in-stream habitat restoration efforts are attempts to provide temporary habitat features that are important for the survival of fish and other aquatic life until future mature conifer trees are provided to the channel from Riparian Reserves and through hillslope processes.

The basis for the importance of large size live trees and down logs in the riparian zones of 1st and 2nd order streams was established in the Tioga Creek watershed analysis where a review of old stream habitat surveys indicate a number of huge, naturally occurring log jams from the junctions of many Tioga Creek tributaries. These jams were the result of active hillslope processes (landslides and debris flows) that deliver large mature trees/logs and substrate to higher order fish bearing streams from as far away as ridge top locations. The rate of landslides and debris flow occurrence cannot be determined, but the evidence of jam size establishes large periodic debris flow disturbances as being within the range of natural variability of physical processes within Tioga Creek Subwatershed.

Only unit 13b contains Oregon Coast coho salmon or Oregon Coast steelhead trout. Unit 15h is probably the largest alder conversion unit and it is approximately 1.25 miles above listed fish presence.

Although no habitat surveys have been completed, streams in the alder conversion units do contain a fair amount of existing coarse woody material. Much of this coarse woody material was left from the initial harvest. A coarse woody material recruitment gap will exist between the time hardwood buffer trees mature and die and drop across the stream channel and when planted conifer reach a size to provide functional stream and riparian zone structure.

Stream stabilization

No data exists which measures the current streambank stability for channels within these proposed management units. The 2000 Oregon Department of Wildlife habitat survey of 16.8 miles of mainstem Tioga Creek over 19 separate stream reaches shows that streambank are very stable. Fourteen of the 19 reaches showed 0% active erosion while the remaining 5 reaches had 1% active erosion. Units within the management area, though higher energy streams, are expected to be equally stable.

Soils

The Tioga Creek Density Management area is located in the Coast Range physiographic province. The geologic materials associated with the soils of the area are developed from the Tyee formation. The Tyee formation is composed of rhythmically bedded sandstone and siltstone. The Tyee tends to have high ground water in some areas, rapid runoff, steep slopes, and sharply alternating beds of sandstone and softer siltstones. The potential for slumps, debris, and earth flows are intensified by these characteristics. These types of slope failures have the greatest impact on the road system.

The soils found within the proposed thinnings are Kirkendall silt loam, Milbury Bohannon-Umpcoos association, Preacher-Bohannon loams, Umpcoos-rock outcrop association, Preacher-Blachly association, Blachly silty clay loam, Preacher-Blachly-Digger association, and Remote-Digger-Preacher complex. Specific soil data can be obtained from the Soil Survey of Coos County, Oregon,

1989. Table E 1. and Table E 2. show Soil Type and Erosional Susceptibility & Compaction Hazard, respectively and can be found within Appendix E

Hydrology

Stream Flow

The project area has a Mediterranean type of climate with cool, wet winters and warm, dry summers. The hydrology of the area is driven by precipitation in the form of rain. The peak flows, low flows, annual flows and groundwater levels are all dependent on the amount, intensity and distribution of rainfall. Precipitation in the watershed varies from approximately 80 inches near the confluence with Williams River to 60 inches in the headwaters to the East, with 90% of the precipitation occurring between October-April. The close correlation between precipitation and runoff indicates that this system rapidly translates rainfall into runoff due to a high drainage density, low bedrock permeability, high precipitation totals, and steep slopes in the headwaters. Land management practices in the project area, including timber harvest and road building, have potentially influenced flow magnitude and timing in some streams.

Higher than normal peak flows can occur as a result of warm, rain on snow events in the Transient Snow Zone (Harr and Coffin, 1992). The TSZ is defined as land between 1800 and 5000 feet in elevation. Approximately 3.2% of the Tioga Creek subwatershed, and some of the proposed thinning units, lie within this zone. However, given the small portion of the watershed in TSZ, the quantity and duration of snow accumulation does not normally produce rain-on-snow runoff events.

Streams found within the analysis area consist of predominantly the A, B, C, and F streams types under the Rosgen classification system, with type A constituting approximately 65% of the total (Rosgen 1994). Stream orders are primarily 0 through 3rd, with higher 5th and 6th order streams occurring on the mainstem Tioga Creek. A 7th order stream is formed at the mouth of the Subwatershed. Table 8 below lists the existing stream summaries for the Tioga Creek Subwatershed.

Table 6 - Tioga Creek Subwatershed Existing Stream Density Summary

Stream Order	Length (miles)	Drainage Density (mi/mi ²)
1	191.3	4.97
2	61.7	1.60
3	33.5	0.87
4	15.5	0.40
5	9.0	0.23
6	8.7	0.23
Total	319.7	8.30

Water Quality

Water quality standards are determined for each water body by the Oregon Department of Environmental Quality (ODEQ). These standards are designed to protect each water body for its most sensitive beneficial use (Miner 1996, p. 1). The most sensitive beneficial use of surface water in the Tioga Creek Subwatershed is habitat for resident and anadromous fish and other aquatic life. Water bodies that do not meet water quality standards are placed on the states' 303(d) list as Water Quality Limited (ODEQ 1998).

The Oregon Department of Environmental Quality (DEQ) listed the South Fork Coos River, Tioga Creek, Morgan Creek, Daniels Creek, as well as the Williams River in the 1988 Oregon Statewide Assessment of Non-point Sources of Water Pollution as potential sources. The water quality parameters identified as potential problems that could be related to past management practices are: nutrients, sediment, erosion, structure, turbidity, and temperature.

Stream Temperature

The 1998 303(d) list designates Tioga Creek and Burnt Creek as water quality limited for temperature from their mouths to headwaters.(OR-DEQ 2000). Elevated stream temperatures are primarily due to a lack of stream shading, a high width to depth ratio and/or low summer flows (Moore and Miner, 1997). All of these conditions result in additional stream heating. A lack of shade allows an increase in solar radiation at the stream surface. A high width/depth ratio allows more surface area to be impacted by solar radiation per volume of water. Lower flows or volume contribute to elevated stream temperatures since the change produced by a given amount of heat is inversely proportional to the volume of water heated. Some reaches of Tioga Creek and Burnt Creek are subject to all of these conditions. Other perennial streams in the Tioga Creek Subwatershed may also have elevated summer temperatures and potentially contribute to high temperatures in reaches of Tioga Creek.

The 10-year water temperature record at the Tioga Creek gaging station shows that as stream flow drops in the summer the water temperature rises. Records for 1996 and 1997, on Tioga Creek, NWNW Sec. 20, T. 26 S., R. 9 W., show stream temperatures exceeded 64EF for 46 days on Tioga creek and had a 7-day maximum temperature of 72EF.

Sediment

There are no streams currently listed by ODEQ as impaired by excess fine sediment in the project area. However, due to past management activities, excess fine sediment and the resulting degradation to water quality and aquatic life (see fisheries report) is a major concern. According to MacDonald (1991, p. 98), "An increased sediment load is often the most important adverse effect of forest management activities on streams." Forest management has the potential to increase both the erosion rate and the rate of delivery of sediment to stream channels. Therefore, due to past forest management in the project area there is an increased potential for stream reaches to be impaired by excess fine sediment.

According to Reid (1981), Reid and Dunne (1984), and others, forest roads can be a major contributor of fine sediment. Sediment delivery to the drainage network may be increased by down cutting of ditch lines and by erosion of unprotected road surfaces from overland flow. Landslides can occur, as road drainage is concentrated on unstable or erosive slopes. In addition, failures of inadequate road/stream crossings have the potential to increase erosion and sediment input to the streams. Several existing roads or road sections associated with the proposed project show evidence of surface erosion, inadequate drainage, inadequate stream crossings or unstable cut banks and fill slopes. These roads are likely causing an increase in sediment delivery to their respective drainage networks.

Channel Condition and Large Wood

Tioga Creek, Burnt Creek and other streams in the project area are deficient in large wood and down-cut to bedrock in several reaches. A lack of large wood and disassociation from the floodplain has allowed increased stream velocities to continually scour stream channels and remove gravel substrate during high flows. Stream surveys were conducted on most of Tioga Creek by Oregon Department of Fish and Wildlife (ODFW 2001) between August-September 2000. Results of the surveys show that some of the upper stream reaches surveyed had a "desirable" volume of woody material. However, most of the surveyed reaches (17 of 18) had a lack of key pieces of large wood that can serve to reduce stream energy, capture substrate, stabilize stream beds and banks, aggrade the stream channel and re-establish a connection with the floodplain. Large, key pieces of wood capture other woody material and are less likely to be washed downstream. "Key" pieces were defined as those greater than 60 cm in diameter and greater than 10 m long. ODFW defines "desirable" and "undesirable" habitat conditions based on values of surveys from other forested reference areas (ODFW 1999, p. I- 47).

According to MacDonald (1991, p.128) "The practice having the most widespread influence on [large wood] in Pacific Northwest streams has been the harvest of trees from riparian areas." The proposed project area, judging from its position in the watershed and present riparian condition, has historically depended on large wood to provide the functions noted above and to provide aquatic habitat (see fisheries report). Most riparian areas in the Tioga Creek Subwatershed have been harvested in the past, and ODFW stream surveys also found conditions for potential recruitment of large wood to be "undesirable" in most reaches surveyed. According to survey results "The trees found most frequently in the riparian zone are 3-15cm dbh hardwoods (ODFW 2001, p. 1)."

Botany

Threatened & Endangered/ Survey & Manage Species

No Threatened & Endangered plants in the Tioga Creek Subwatershed. The areas to be treated range from 28 to 72 years old. This age class of timber is typically dense, creating low light levels in the interior of the stand. Due to the lack of light, a large portion of these stands have very little understory, and existing understory tends to have low species diversity. On the other hand, these are large

stands with various gaps, edges, rock outcrops, hardwood patches and riparian areas which contribute greatly to plant diversity in the stand as a whole.

Units 1-8 have been surveyed for vascular plants, lichen, and bryophytes. It is expected that surveys of remaining units will result in similar species being found. Giant foldleaf (*Diplophyllum plicatum*), has been located in units 5b, 6b, and 8. There is also a known site of this species outside of the units at the junction of 26-09-17.0 and -21.0 roads. This is an Oregon Natural Heritage Program assessment species and Survey & Manage Category B species, which requires management of known sites. It is typically associated with old-growth forests in the riparian zone of perennial streams. The site in 5b is on legacy material, an old cedar stump. Giant foldleaf was found on three sites in Unit 8. One site is on a couple of conifer stumps on a bench below the road. This site is the farthest from water that we know of in the area. Another site is on a couple of western redcedar stumps near a stream. The last site is on a small (6" diam.) Douglas-fir snag near a stream.

Black gel cup (*Sarcosoma latakense*) has been found in unit 8. It's habitat is typically duff in coniferous forests. Apricot jelly mushroom (*Tremiscus helvelloides*), was found in the road bed and shoulders of the 26-10-24.3 road, outside the unit boundary. Rosy cup (*Neourmula pouchetii*) has been located in unit 5a on the -13.0 road. All these mushrooms are Survey & Manage Category B species, a designation that requires that all known sites be managed.

A waterfall moss (*Platyhyridium ripariodes*) was found in Unit 8 near the giant foldleaf site on the redcedar stumps. There is another site of this species just outside of Unit 4. This is an Oregon Natural Heritage Program review species.

An Oregon Natural Heritage Program tracking species has been noted in the project area. Cusick's checkermallow (*Sidalcea cusickii*) was noted on a large rock bluff above the eastern end of Unit 4. Tracking species are not a management consideration. This species is common on rock outcrops throughout the Umpqua Resource Area.

The general Burnt Mountain area is the hotspot of species abundance in the ranges of both *Diplophyllum plicatum* and *Platyhyridium ripariodes*. These species are more rare elsewhere in their range.

Port-Orford-cedar

POC is susceptible to the introduction and spread of the root disease *Phytophthora lateralis*. *Phytophthora lateralis* is spread by either fungal spores or by direct root contact between healthy and infected trees. The fungal spores may persist within the infected root mass of dead POC for up to 7 years. These spores can be transported by water, equipment, and even foot travel by animals and humans. When trees are isolated from each other, the disease cannot spread by root grafts. Spores can be transferred downhill in porous soils by subsurface and surface flow of water. Spores can also be transported by mechanical attachment of soil particles to equipment, logs being skidded, and human or animal feet both wild and domestic.

The South Fork Coos Watershed is on the extreme northeastern end of the natural range of Port-Orford-cedar (POC). In this part of its range, POC is more typically found growing on upper slopes, ridge tops and south facing benches. Timber cruise data from the 1960s through 1994 show 14 BLM timber sale units in this Watershed contained POC. The highest concentration of POC on BLM land was in section 34, T.25S., R.9W., where 5 timber sale units, containing 276 POC trees, were sold. A proposed but dropped unit in section 10, T.26S., R.9W., contained 68 POC. In the rest of the timber sale units, POC numbers were no higher than 22 and commonly much less. The only known mature POC trees on BLM land in this watershed are in section 10, T.26S., R.9W. Those POC trees are inside the LSR and the road accessing that area is blocked. Second growth POC are growing next to Tioga Creek and Burnt Creek in sections 31 and 32, T.26S., R.9W. No POC has been found within the harvest units nor is any POC growing along the proposed haul routes. (South Fork Coos Watershed Analysis Ch. 5, Pg. 6)

Noxious Weeds

The Tioga Creek subwatershed is known to contain Himalayan blackberries, gorse, Scotch and French brooms, common St. Johnswart/Klamath weed, Canada and bull thistles, and tansy ragwort. Gorse is located in T.27 S., R.09 W., Sec 15, 23, and 24. Scotch broom is established throughout the subwatershed but is mostly located along the Burnt Ridge Road system with a few plants on the gravel roads. French broom is a newcomer and is scattered along the roads. Himalayan blackberries, Canada and bull thistles, and tansy are found on open ground throughout the subwatershed. Biological agents currently control tansy.

Recreation

The Tioga Creek Subwatershed offers undeveloped, dispersed recreation opportunities and is popular for day use and camping, particularly during hunting season. There are no large, developed recreation sites in the affected environment and none planned. The

primary facility used for recreation is the road system. Nearly 16,000 acres of public lands are available for any legal recreational activity.

The area is generally steep and forested with old gravel stockpiles, crossroads and log landings providing open areas suitable for camping or parking and walking. Most openings are less than a half acre in size and are frequently used as undeveloped campsites during summer weekends and hunting season.

The Bureau of Land Management maintains one small, developed recreation site within the proposed action area called Burnt Mountain. The site is less than one acre in size and provides six camp/picnic units with tables, fire rings and a vault toilet. The site is on Oregon and California Land Grant lands and is not withdrawn from the public land laws for recreation, meaning other activities could occur at the site. There are several similar recreation sites in the region, outside the affected environment.

Visitor use is estimated through staff observations, traffic counters and private company visitor passes. Conservative estimates for numbers of visitors recreating on Bureau of Land Management lands in the subwatershed are 4,000 people per year. Popular recreational activities include adventure/exploring by vehicle and on foot, scenic driving, camping, looking for wildlife, picnicking, hunting and fishing, walking/hiking, and bicycling.

Recreationists who use the Coast Range forest roads tend to be local and regional residents and former residents rather than tourists. They use and appreciate the undeveloped, unpopulated recreation opportunities. According to the Coos County Tourism Plan of 1996, most visitors to coastal Oregon counties come to see and be near the ocean. Few of the tourists venture into the Coast Range.

Prior to Spring, 2001, The Weyerhaeuser Company (Weyco) allowed limited recreational use on their lands in the subwatershed by issuing vehicle passes to the public by request. Day use activities included picnics, playing and swimming in the river, fishing, walking, driving for pleasure, wildlife and nature appreciation. Camping permits were issued for hunting season and during weekends in summer. Public use was limited to the Dellwood mainline road only. The security company issuing permits estimated 1,000 vehicle passes were issued annually, with 3.5 people per vehicle or about 3,500 visitors per year.

The Weyerhaeuser timber company (Weyco) recently changed their public use policy due to a variety of concerns. There are now locked gates at several locations on the Dellwood mainline road. Public use is permitted along the river on the Dellwood mainline road on Saturday and Sunday only, with no camping and no fires allowed.

Federal, state and county officials in cooperation provide Law enforcement with one another on public and private lands. The three top concerns in the region for Bureau of Land Management Law Enforcement Officers are:

1. Illegal dumping
2. Special Forest Products Theft
3. Marijuana Cultivation

The area under consideration in this analysis is part of the proposed Tioga Special Recreation Management Area in the District Resource Management Plan. Special Recreation Management Area is defined in the Bureau of Land Management 8300 - Recreation Manual in part: "...Public lands where a commitment has been made to provide specific recreation activity and experience opportunities on a sustained yield basis." If the area is not managed as a Special Recreation Management Area, it would be considered part of the Extensive Recreation Management Area for District reporting purposes.

Extensive Recreation Management Area is defined as "Bureau of Land Management administrative units where recreation management is only one of several management objectives and where limited commitment of resources is required to provide extensive and unstructured type of recreation activities. They may contain recreation sites. These areas consist of the remainder of land areas not included in Special Recreation Management Areas within a resource area or district."

The affected environment is currently managed as an "Extensive" rather than "Special" Recreation Management Area. Either way, recreation opportunities would not be affected or lost by the proposed action. No other special designations or proposed designations, such as Wilderness Area, Off-Highway Vehicle Open Area, Wild and Scenic River nor Back Country By-Way, are within the boundaries of the proposed action.

Area of Critical Environmental Concern

The Tioga Creek Area of Critical Environmental Concern is located in T.27 S., R.09 W., Sec. 17 and is about 40 acres in size. The main tributary of Tioga Creek is in section 17 and is buffered approximately 200 feet on each side. Proposed activities should be consistent with the Area of Critical Environmental Concern management plan.

Cultural Resources

Within this project scope, thinning units are generally located on steep hillsides, while conversion units are generally located on streamside terraces. Units on both landform types were previously harvested between 25 and 75 years ago.

Potential historic resources include localities related to early settlement (towns and homesteads) and previous logging activities, while potential prehistoric resources include localities related to settlement (camps and villages) and resource extraction (hunting, fishing and gathering).

Although some potential historic resources related to previous logging activity could be located on the steep-sloped thinning units, most potentially significant historic and prehistoric resources are more likely to be found on the relatively flat conversion units.

Class I survey (records check) identified four historic resources in the vicinity of project units: “old” Tioga townsite; Coos River fish hatchery; J.H. Flournoy cabin (1896) and a section of the “Old Coos Bay Trail” (1898). No prehistoric resource locations were identified in the vicinity of project units.

Reconnaissance level field surveys were conducted in areas with potential cultural resources. This survey confirmed the location of the Tioga townsite. It is now represented by a 50 ft. by 50 ft. concrete slab, located on the south margin of Unit 14b. No evidence of the Coos River fish hatchery still exists. Structures were removed many years ago and recent road construction obliterated the ponds associated with this hatchery. The 1898 cabin was not relocated. This was not unexpected; as the area has been harvested since this structure was abandoned, which likely removed any remaining structural evidence. The trail route (adjacent to Unit 10) now is the location of Bureau of Land Management road 26-10-25.0, which likely covered any evidence of this trail. No additional historic or prehistoric cultural resource locations were discovered during field survey.

Fuels Management

The subwatershed and project areas contained therein have a catastrophic fire history as recent as the late 1800's and since then, fire suppression activities have all but eliminated natural fire from the landscape (East Fork Coquille WA, p. 16, 18). Recent harvest activities on both private and Bureau of Land Management administered lands that are adjacent to or near the proposed project areas have received some form of site preparation or fuels treatment to reduce fuel loadings and prepare the site for reforestation. Most commonly these have been in the form of hand or machine piling, cover and burn, and broadcast burning.

Solid & Hazardous Materials

Project development personnel have performed Level I surveys on proposed work locations. No recognized environmental concerns have been identified, although the general locations of the proposed projects have been used for illegal dumping in the past. The district hazardous materials specialist as needed will investigate further identification of concerns.

Environmental Justice

The proposed area(s) of activity are not known to be used by, or disproportionately used by, Native Indians, minority, or low-income populations for specific cultural activities, or at greater rates than the general population. This includes their relative geographic location and cultural, religious, employment, subsistence, or recreational activities that may bring them to the proposed area(s). Also, Bureau of Land Management concludes that no disproportionately high or adverse human health or environmental effects will occur to Native Indians, minority, or low-income populations as a result of the proposed action(s). Therefore, Environmental Justice will not be further analyzed in this document.

Road Density

The current calculated road density for the Tioga Creek Subwatershed on federal ownership is 3.7 (mi./mi²). This is based upon calculated road mileages on BLM lands of 91.06 miles (96.34 + 3.13- 8.41 miles) (Table 7 below) covering an area of 15,778 acres (Table 2 page 16) or 24.65 miles². The area is within Oregon Department of Fish and Wildlife's Tioga Big Game Unit. The *Coos Bay District Resource Management Plan's* goal for road density within the Tioga Big Game Unit is to maintain 1.1 miles of road per section per watershed with a maximum density of 2.9 miles per section per watershed (RMP ROD p. 29).

For this proposed project, road mileages on federal ownership will not increase above the 1994 BLM base road miles within the Tioga Creek Key Watershed. (refer to Regional Ecosystem Office memo dated April 7, 1995, titled *Road Access Policy for Key Watersheds*). Table 9 below lists out the current road mileages on federal ownership.

We do not have any culverts needing upgrade for fish passage within the project area.

Table7 - Current Road mileages with the Tioga Creek Subwatershed, 1994 to present

<i>Tioga Cr. Subwatershed</i>	<i>*1994 Roads on BLM</i>	<i>*1994 BLM Controlled Roads on Private</i>	<i>*1994 BLM Base Road Miles</i>	<i>*Private and BLM Road Construction 1994 to date</i>	<i>**1998+ Tioga Subwatershed Road Decom.</i>	<i>2000 Road Miles in Tioga</i>
BLM BST	14.75	4.25	19.00	0.00	0.00	19.00
BLM ROCK	49.84	8.35	58.19	0.00	8.02	50.17
BLM NAT	4.25	0.56	4.81	0.39	0.39	4.81
JOINT BST	4.46	4.75	9.21	0.00	0.00	9.21
JOINT ROCK	2.09	2.55	4.64	0.23	0.00	4.87
JOINT NAT	0.54	0.46	1.00	0.00	0.00	1.00
PVT BST	0.00	0.00	0.00	0.00	0.00	0.00
PVT ROCK	0.60	0.00	0.60	2.19	0.00	2.79
PVT NAT	3.81	0.00	3.81	0.17	0.00	3.98
NON INV	16.00	0.00	16.00	0.15	0.00	16.15
TOTALS	96.34	20.92	117.26	3.13	8.41	111.98

* The data is based on a GIS run dated 01/16/2001

** The data is based on a Timms run dated 7/14/2000

In-Stream Restoration

Watershed restoration, including removing and upgrading roads, silvicultural treatments within Riparian Reserves, and restoring stream channel complexity is a component of the Aquatic Conservation Strategy. Restoring structural complexity to stream channels cannot stand alone when attempting to restore degraded habitat condition. Riparian and upslope restoration should accompany in-stream restoration.

The watershed analysis indicated that stream cleaning in the form of log salvage or timber sales logging debris removal and fish passage improvement was a common land management practice in the Tioga Creek Subwatershed. In many situations, large complex log jams, as well as the logging debris, was removed most commonly to provide upstream access for anadromous fish. The removal of complex coarse woody material also reduced and limited aquatic habitat features. The lining or felling of whole mature conifer trees into the stream channels of third order or greater is the most feasible immediate option to restore lost coarse woody material. An alternative, where mature trees are unavailable, is to place "key piece" sized logs in the stream channel in the form of complex jams. Recommendations for placing coarse woody material in Tioga Creek can be found in the Watershed Analysis. Key pieces of coarse woody material in this size range function as large, durable logs in stream channels. Variation in size exists to accommodate a variety of stream sizes and functions.

CH. 4 - ENVIRONMENTAL CONSEQUENCES

Vegetation - No Action - Density Management Areas

Direct: As the trees grow at full occupancy of the site, competition for growing space results in competition mortality. At the individual tree scale, intense competition would reduce resources available for diameter growth, and for root and foliage expansion or replacement.

Indirect: Closed canopy stands allow little light to reach the forest floor. With reduced light the less shade tolerant herbs and shrubs die out first and as competition for light in the overstory increases nearly all the plants in the herb and shrub layer die. These stands are in the stem exclusion stage of stand development (Oliver; Larson 1990, pgs.146-147), which are in the successional stage with the lowest species diversity (sources summarized by Spies 1991, pgs18) and the stage that provides primary habitat for the fewest wildlife species (sources summarized by Harris 1984, pgs. 59-64 and displayed in figures 5.10-5.13).



Figure 5 - Crown Closure Hatcher Creek Tioga D.M.

As competition intensifies, light availability to the lower crown decreases. When light levels in the lower crown fall below that which would support net photosynthetic production, the lower crowns die reducing crown length. Trees, with less than 35% of their bole in live crown, are at increased risk of blowdown and wind caused snap-out. Understory tree recruitment and herb and shrub layer reinitiation would begin later than in thinned stands or in understocked natural stands. The understory reinitiation stage of stand development either would begin in response to a moderate severity disturbance that opens the canopy or would occur when the trees live tissue respiration demands reduce photosynthate availability below that needed for lateral growth to occupy gaps created by mortality. Understory reinitiation would be delayed longer in stands with a large component of western hemlock than in Douglas fir dominated stands (Stewart 1986, Wierman: Oliver 1979). However, the crowns of even-aged mixed Douglas-fir/ western hemlock stands would stratify by species with hemlock moving into the lower canopy positions (Wierman: Oliver 1979).

Cumulative: The no treatment alternative would put these stands on a development trajectory that would be very different from the pattern followed by stands that developed into the old-growth forest condition found in the Coast Range today. Where as the candidate stands for thinning are well stocked to overstocked, research suggests that the stands that survived to become old-growth developed as if they were understocked when young (Tappeiner et al. 1997). The higher stocking levels in the candidate stands for thinning would retard attainment of late-successional forest characteristics in that the higher competition severely slows attainment of large tree diameters and subsequent large snag and down wood diameters. The higher stocking also translates to full site occupancy, and a general lack of the stand openings and gaps necessary for recruiting understory trees and associated multi-canopy structural complexity. Barring a moderate severity disturbance, the no treatment alternative would delay attainment of habitat used by late-successional forest associated species. The delay may exceed 200 years depending on the attribute and site quality. No treatment would similarly retard attainment of large in stream structure and riparian forest conditions necessary to meet the Aquatic Conservation Strategy objectives (Density Management and Conversion Treatments and Attaining Riparian Reserves Function section in the South Fork Coos Watershed Analysis [USDI, 2001]).

Vegetation - No action - Alder Conversion Areas

Direct: The alder stands would continue to grow until about age 90-years and would begin a rapid decline shortly thereafter. Few live alders will remain by stand age 130-years (Newton; Cole 1994). Conifers would be present if the conifers established either before the alders or the conifers established in sizeable gaps between alders (Newton et al. 1968). However in the absence of a disturbance, additional conifers are unlikely to become established under a fully stocked alder stand. The understory conifers are at risk of competition related mortality until they emerge above the alders. This could occur about when the alders near their maximum height at stand age 40-years (Newton; Cole 1987).

Indirect: Understory vegetation will respond to changes in the overstory condition. As the stand ages, canopy gaps would form allowing the existing understory vegetation to



Figure 6 - Alder Stand within Tioga D.M.

increase in vigor. As the alder component of the stand breaks-up, more light reaches the forest floor allowing the shrub layer to become very vigorous. (Oliver; Larson 1990, pgs.252-259.)

Cumulative: After 130-years from stand initiation, and assuming no disturbance of sufficient intensity to free growing space, those alder stands without a conifer component but with a salmonberry shrub layer would become brushfields. Trees cannot establish in a salmonberry brush field without a disturbance that frees growing space (Emmingham; Hibbs 1997; Hemstrom; Logan 1986 pgs.24-26, Newton; Cole 1994). Salmonberry bush fields are “climax communities” that are unable to contribute wood to the streams. These sites, which had previously supported a late-successional/old-growth coniferous or mixed-stand forests are currently not on a trajectory to develop into replacement old-growth stands.

After 130-years, alder stands with a conifer component will transition into a low-density conifer stand with very large individual trees (Stubblefield; Oliver 1978, Newton; Cole 1987). Without disturbance, a well-established shrub layer under the low-density conifer stand can preclude recruitment of understory trees thus delaying attainment of the structural complexity associated with late-successional forests. An underburn, either natural or prescribed fire, could set back the shrub layer facilitating understory tree recruitment. However, that carries a risk of loss of the overstory trees, because the overstory trees would be predominately fire intolerant hemlocks and red cedars with few fire tolerant Douglas-firs (sources summarized by Minore 1979). These sites will develop some attributes associated with late-successional forest but will lack others and would be at higher risk of loss to fire.

Vegetation - Proposed Action - Density Management



Figure 7 - Fire Road C.T. 120 tpa Crown Closure post harvest

Conifer Density Management Thinning

Direct: Thinning would increase the growing space for the trees left on the site. As the trees increase photosynthetic surface to take advantage of the growing space, more food becomes available for the leave trees to maintain or increase crown length and volume, root mass, diameter growth and produce the pitch and protective chemicals used by the trees to ward off insect and disease.

Table-1 compares the effects of thinning two 40-year old stands of different site qualities to 60 trees per acre, to 120 trees per acre and the effect of no treatment with respect to attaining large diameter trees, snags and CWD. The 60 tree per acre and the 120 tree per acre treatments represent the upper and lower ends of the range of proposed treatments. As indicated, larger diameters would be obtained sooner on the higher sites with the wider spacings. The information in the table is from summarized from the South Fork Coos Watershed Analysis and in turn derived from computer growth projections run on stand exam data (Density Management and Conversion Treatments

and Attaining Riparian Reserves Function section in the South Fork Coos Watershed Analysis [USDI, 2001]). The two stands used were typical managed stands in that the stands had been precommercially thinned and fertilized.

Indirect Effects of the proposed 100-120 tree per acre prescription¹: Thinning these stands to 100 to 120 trees per acre would provide the growing space to increase average tree diameter and crown depth while retaining enough trees to provide mutual protection during severe storms. In time this would increase the stand's overall resistance to wind damage. The stands would remain in the stem exclusion stage for many years after thinning. However, the treatment would increase growth rates, crown depth, and would result in future larger average green tree, snag and down wood diameters. While the treatment would increase growth rates, crown depth, and would result in future larger average green tree, snag and down wood diameters, an additional thinning or moderate severity disturbance within 15 to 25-years would be necessary to put the stand on a trajectory to develop into old-growth. The primary reason for thinning a stand conservatively to 100-120 trees per acre would be to culture wind firmness in preparation of future treatments that could focus on accruing late-successional habitat attributes

¹ This prescription applied to very dense stands in the project area, which typically had not been precommercial thinned and less than 35-years old, with live crown lengths that are less than 35-40% of the tree height (indicating small root mass) and with small dbh relative to height could be at risk for wind damage during extreme storm events.

Table 8 Projected Age Stands Would Attain Desired Tree and Snag Diameters following Thinning and Compared to No Treatment for Two Different Sites

Initial stand condition at stand age 40-yrs.	Stand attribute	age when stand attribute is attained, assuming no subsequent treatments or disturbances. *		
		Thin to 60-trees/ ac. at stand age 40-yrs.	Thin to 120-trees/ ac at stand age 40-yrs.	No thin
Kings 50-yr site index of 115 and 291 trees/ ac initial stocking for SPS runs. (Corresponds to McArdle's 100-yr site index of 140 (McArdle 1961; King 1966))	ave. green tree dbh > 20-in. **	50-yrs.	70-yrs.	100-yrs.
	ave. green tree dbh > 24-in. ***	70-yrs.	120-yrs.	170-yrs.
	ave. newly dead tree dbh > 24-in. ***	>80-yrs.	> 200-yrs.	> 200-yrs.
	ave. green tree dbh > 32-in. ****	170-yrs.	> 200-yrs.	> 200-yrs.
Kings 50-yr site index of 127 and 259 trees/ ac initial stocking for SPS runs. (Corresponds to McArdle's 100-yr site index of 160)	ave. green tree dbh > 20-in. **	50-yrs.	60-yrs.	70-yrs.
	ave. green tree dbh > 24-in. ***	70-yrs.	90-yrs.	120-yrs.
	ave. newly dead tree dbh > 24-in. ***	70-yrs.	160-yrs.	190-yrs.
	ave. green tree dbh > 32-in. ****	150-yrs.	> 200-yrs.	> 200-yrs.
<p>Notes:</p> <p>Ages and diameters from Stand Projection System (SPS) projection of stand exam data collected following BLM stand exam protocol (USDI 1995)</p> <p>* 20-inches is the average diameter of trees that survived to become old growth when they were 50-yrs old (Tappeiner et al 1997).</p> <p>** 24-inch is the minimum diameter for</p> <ul style="list-style-type: none"> • snag suitable for a pileated nesting tree (Neitro et al 1985)). • in stream wood considered when assessing proper functioning condition using NMFS's matrix of factors and indicators for the Tye Sandstone Physiographic Area. • minimum diameter piece considered as a key piece by ODFW for aquatic inventory purposes. <p>**** 32-inch is the minimum diameter Douglas-fir fitting the definition of old-growth (Franklin et al. 1986).</p>				

Indirect Effects of the proposed 80-100 tree per acre prescription: The treated younger stands on higher quality sites would approach the trajectory to become old-growth in that the stand would average 20-inches dbh soon after stand age 50-years. Older stands and stands on poorer sites would attain 20-inch average dbh sooner than if left un-thinned. Thinning down to 80 to 100 trees/ acre would increase light levels on the forest floor improving the vigor of existing herbs and shrubs, where present, and allow establishment of new shade tolerant plants. The additional light would allow some shade tolerant conifers to establish. However, the overstory tree canopy would rapidly close thus limiting the growth of the understory trees. Without additional disturbance, some understory trees would eventually lose epinastic control and others would die. About 15 to 25 years after treatment, an additional thinning or moderate severity disturbance would be needed to maintain growth rates and hold the stands on trajectory. All other things equal, a stand thinned to 80 to 100 trees/ acre would progress from the stem exclusion to the understory re-initiation stage of stand development sooner than an untreated stand.

Indirect Effects of the proposed 60-80 tree per acre prescription: Thinning stands leaving 60 to 80 trees per acre would put 40-year old and younger stands on a trajectory to develop into old-growth as defined by attainment of an average stand dbh of 20-inches by age 50-years. Thinning older stands to this spacing would provide the growing space to obtain 32 to 40-inch diameter trees at a younger age than otherwise would occur if the stands were left un-thinned. This thinning intensity would shift stands from the stem exclusion stage to the understory reinitiation stage of stand development by allowing sufficient light to reach the forest floor to allow



**Figure 8 - Scare Ridge C.T. 80 tpa
Crown Closure post harvest**

understory tree regeneration and recruitment of a shrub and herb layer. This would result in the stands having a two-story canopy with predominantly shade intolerant overstory trees and shade tolerant understory trees, and wider range of tree sizes and ages.

If sufficient understory trees regenerate to form a fully stocked understory stand, those understory trees would also reduce the light levels reaching the forest floor causing a decline and even exclusion of understory herbs and shrubs (Deal; Farr 1994). Over time and with the absence of moderate severity disturbance, the two-aged, two-story character would become less distinct as the crowns of the understory hemlock and cedar trees grow into and merge with the low part of the overstory Douglas-fir canopy. However, the merged overstory-understory would retain species diversity and structural complexity. This would occur when the overstory tree height growth slows and the

understory trees grow to where their crowns merge with the lower canopy of the overstory, and is facilitated by large canopy gaps that allowed continued understory tree growth and retention of deep crowns on the overstory trees. The stand would be considered single-aged when age difference between the overstory trees and the understory trees is less than 20% (Smith 1962). This would be about stand age of 150-years for stands where understory was recruited at age 30-year, and about age 325-years for where an understory was recruited at age 65-years. Consequently, renewal of strong contrasts between distinctive canopy layers and age classes would require either frequent low severity or periodic moderate severity disturbances. Stands with myrtle or maple dominated understories would retain a pronounced two-story character.

Stands in this proposed project, with average tree diameters that are less than 15-inches, would have few large trees available for concurrent or near term snag and down wood recruitment. Thinning the younger stands to 60-80 trees per acre would attain the growth rates exhibited by the Coast Range old-growth trees when they were young and would produce the largest diameter down wood and snags.

Cumulative: At the stand scale, thinning would decrease the time each stand is in the stem exclusion stage thus moving each stand into the understory re-initiation stage of stand development. Along with this successional progression is a more rapid attainment of average stand diameters of 20-inch and larger. This corresponds to a shift from secondary habitat to primary habitat conditions for several mammals and attainment of nesting conditions for several birds associated with mature and old-growth forests (sources summarized by Harris 1984, pgs. 59-64). Trees 20-inches and larger would permit recruitment of larger snags, which would provide function as habitat longer than smaller diameter material (Cline et al. cited in Brown 1985).

At the landscape scale attainment of conditions associated with mature and old growth forests, multi-species multi-canopy larger average tree size and subsequently larger snags and down wood, within treated stands reduces the contrast between those treated stands and the adjacent old-growth stands. This softens the edges between the older and younger stands making boundaries more permeable and by that expands the area of suitable habitat for old-growth associated species (Harris 1984, pgs. 59-64). Applying a range of stand level prescriptions would provide for landscape diversity in average stand diameters and spread out the timing of large snag and down wood recruitment.

Vegetation - Proposed Action - Alder Conversion

Direct: Alders stands, on sites where merchantable conifer stands had been previously harvested, would be replaced by new conifer stands. Site preparation following alder cutting would increase the number of plantable spots. The new stands on sites supporting hardwood species other than alder would have a hardwood component and a potential to develop into a mixed stand. Depending on subsequent management and/or disturbance, these new conifer and mixed stands would be set on a development trajectory to develop into old-growth.

Indirect: Overtopped conifers, which can release, would go through a period of shock until their shade needles are replaced by sun needles. Many of these conifers would be at risk of lodging or blowdown until they can take advantage of the increased growing space and develop favorable diameter to height ratios and expanded root systems. Conifers not capable of releasing would either die of shock or fail to regain epinastic control (ability to attain vertical height growth). Conifers that do release would contribute to the structural diversity of the new stand.

The removal of the alder component would increase the growing space for the vegetation left on the site, and for new plants that are subsequently seeded or planted on the site. Site preparation would temporally reduce herb and shrub cover and by that reduce interspecies competition enough to allow successful conifer regeneration and establishment. In combination, these treatments increase the sunlight reaching the forest floor resulting in higher photosynthesis rates for the residual and new plants. Following alder cutting

and site preparation, the herb and shrub layer plants that escaped disturbance, and species on the site before treatment that can regenerate from stump sprouts, root suckers, rhizomes, root crowns, or other asexual means will rapidly recolonize the site. Pioneer plants, with light wind disseminated seeds, would germinate throughout the treated area. However, only those seedlings that sprouted on open ground away from the highly competitive resprouting plants have a reasonable chance of adding to the species composition of the new stand. Logging debris would provide a pulse of fine and coarse woody material to the forest floor. In the near term, this debris would add to the fuel loads, pin down some residual plants facilitating propagation of those species that can asexually regenerate through layering, reduce plantability, provide small mammal habitat, and moderate the microclimate near the ground. In the longer term, the decomposed logging debris would add organic matter to the soil and release nutrients for recycling. The increased sunlight would warm the soil increasing microbial activity. This would result in increased decomposition rates and nutrient cycling, and increase root growth and efficiency of nutrient and water uptake by vascular plants.

Cumulative: Alder conversions across the landscape would increase the area and continuity of conifer cover, and by that restore forest type patterns more typical of the landscape just prior to intensive management for wood products. Alder conversions would increase the area supporting habitat suitable for late-successional/ old-growth associated species and decrease the amount of habitat used by species associated with alder dominated disturbed sites.

Wildlife - No Action

Special Status / Survey & Manage Species

There would be no negative consequences for wildlife if the No Action Alternative were adopted. Noise disturbance impacts to northern spotted owls or marbled murrelets beyond background levels, would not occur. The long term consequences are a delay in development of stand attributes used by late-successional forest associated wildlife species of concern, and a slower expansion of the amount of suitable northern spotted owl or marbled murrelet nesting habitat in the watershed. Large trees with old-growth related structure such as large mossy limbs would develop slowly, or may not occur in un-thinned stands due to competition of the trees at a high stocking level.

General Habitat and Associated Wildlife

The entire proposed harvest units were set on a trajectory for maximum volume production through single species planting with a high density and even spacing. This resulted in a closed single story canopy that quickly dominated the sites, limited the development of understory vegetation. This habitat has little value except to mid-seral wildlife species. Some wildlife species associated with old-growth conditions may be present in the short term if “legacy” features, such as coarse wood material, were retained from the previous old-growth stands. These stands were managed for a final harvest at approximately 40- 80 years old. As these stands exceed this age without manipulation, their annual growth rate will decline, and their risk of blowdown increases due to a decline in their relative root mass, and decline in their diameter to height ratio (Oliver and Larson 1990pgs 75-77, 206-209). Suppression mortality kills the smaller trees in the stand and will provide snags and down wood, but they will be small in size and will last a relatively short time. Few large trees die because of competition (Peet and Christensen 1987). Instead, insect, disease, mechanical, or weather related injury or disturbance cause most mortality among large trees. High stand densities would delay attainment of large diameter trees and consequently also delay attainment of large-diameter down wood and snags. Stand projection simulations suggest it will take an un-thinned stand 200 years to regularly produce large diameter forest structure associated with late-seral stands (USDI 2001 - Ch.14, pg. 16) In contrast, Tappeiner et al. (1997) found that many Coast Range old-growth stands developed under low stocking densities and developed large diameter trees capable of providing large structure by the time those trees were 50-years old. Barring windthrow or other such catastrophic events, the trees will have short crowns and small diameters relative to their heights, small length and diameter branch size, and low root mass. Limited understory conifer regeneration would occur and would be confined to open patches and edges. The understory conifer that established would not be vigorous, would have little to no growth, and would have flat-topped growth forms. The canopy cover would remain the same, which would deter the development of understory shrub, herb, and forb layers. Vertical stand complexity would remain relatively unchanged over the next several decades. Suppression mortality would provide snags and down wood, however they would be small in size and last a relatively short time. Although the small dbh snags typically created by suppression mortality would not provide suitable nesting habitat for the larger cavity associated species, they would provide an important feeding resource for most cavity associated species and their prey. There would be no snag or down wood creation, that would leave those stands proposed for treatment deficit in these structures. The dense areas of suppressed Douglas-fir would remain until the stand had self-thinned, delaying attainment of some late-successional characteristics for as long as 200 years (South Fork Coos WA, Ch.14, Pg. 16)

The instream project sites may recruit down wood from suppressed trees that fall over, or from landslides, but this would be at a slower rate, and with smaller diameter trees than if the down wood was placed instream.

No disturbances associated with harvest or road related activities would occur. There would not be any impact of 3.5 miles of new construction, or 35.0 miles of renovation/improvement. The road density for the watershed however would not be reduced, as the associated road decommissioning of 15 miles would not occur. The old roadbeds would not be blocked, so they could be used by motor vehicles that would cause disturbance, and the culverts would still be present. Due to the lack of vegetative growth, terrestrial habitat connectivity would not be improved on the roads that are proposed to be decommissioned. The compacted roadbeds would prevent vegetative growth of trees and large woody shrubs in the road prism. Any vegetation that did begin to grow in the prism could be killed or stunted by vehicle traffic. Individual mortality/injury to less mobile wildlife species would be a negative affect that would occur over the long-term as the roads would continue to be open to vehicle traffic.

Cumulative Effects

There would be no local level cumulative impacts. Landscape level cumulative impacts have been analyzed in the environmental impact statements to which this EA is tiered (USDA; USDI 1994; USDI 1994).

Wildlife - Proposed Action

Density Management

All Actions: Negative impacts to wildlife from the Proposed Action would be short term. The major short-term impact of potential noise disturbance on northern spotted owls and marbled murrelets would be mitigated by the appropriate seasonal and daily timing restrictions from the USFWS Biological Opinion (2000). However, there are no known marbled murrelet nest sites in or within 1/4 mile of proposed project areas. All projects that require equipment use could create short-term negative impacts from physical disturbance and possible fuel or lubricant spillage/leakage from equipment.

The proposed action combines 9 treatment types over the subwatershed's Late-Successional Reserve in an approximate five-year treatment window. The Proposed Action would minimize the habitat and noise disturbances to wildlife by consolidating these treatments in time and location; this is one of the guidelines for LSR management (LSRA p. 69).

All Actions - Consultation: The proposed project is a "may affect, not likely to adversely affect" determination for the northern spotted owl. The project is a "may affect, not likely to adversely affect" determination for the marbled murrelet for all activities except road construction, renovation, and decommissioning. The project is a "may affect, likely to adversely affect" determination for noise disturbance for the marbled murrelet for road construction, renovation, and decommissioning. A Biological Assessment for the Tioga Creek Subwatershed was submitted to the U.S. Fish and Wildlife Service on July 26, 2000. A Biological Opinion and written concurrence was received from the Service on September 29, 2000. All Project Design Features, and Terms and Conditions from the U. S. Fish and Wildlife Service Biological Opinion, will be implemented. The activities should not negatively affect any other Special Status Species, as there was no presence of special habitats or documented sighting of species.

Special Status / Survey & Manage Species

Northern Spotted Owl:

The thinnings would not remove or degrade suitable habitat for the northern spotted owl. The treatments would not negatively affect any constituent elements of Critical Habitat. In addition, an analysis of the proposed units and the three criteria of blocked acres, land ownership distribution, and location from the core listed in the Late-Successional Reserve Assessment (LSRA p. 71) indicated that none of the proposed units would create a high risk situation within the home range acreage of any of the owls in the project area (Table WL-3, wildlife analysis file).

Total dispersal habitat, which includes suitable habitat, available to northern spotted owls on federal lands within the South Fork Coos River 5th field watershed is 19,734 acres (62%) and within the East Fork Coquille River 5th field watershed is 27,757 acres (61%). In the short term, a total of 1830 (3.7%) acres of dispersal habitat will be modified in the two 5th fields through density management thinning. Recent analysis of dispersal data by Eric Forsman and presented at BLM's Roseburg District Office on 28 February 2000, suggests that LSRs in southwest Oregon are currently well connected to each other, facilitating dispersing juvenile and subadult spotted owls, despite ongoing management activities. Dispersal habitat is expected to continue functioning as suitable dispersal post harvest. Stands are currently near 100% canopy cover. The proposed actions would reduce canopy cover but would maintain at least an average of 60% canopy cover in the units. Canopy cover should rapidly increase within 5-10 years after harvest. Thomas, and coauthors, (1990) suggested stands greater than 40% canopy cover could function for spotted owl dispersal. The proposed stands are currently marginal dispersal habitat because they have small average stand diameters, are very dense (thereby impeding mobility), and

contain little structural diversity. Immediate post harvest, the stands would still be marginal dispersal habitat because they would still have small-average diameters (although treatments will increase tree growth rates over time), open (thereby offering less protective cover). However, project design features would result in the treated stands becoming somewhat more structurally diverse.

The treatment for stands greater than 40 years of age would not reduce the stands' canopy closures below 60 percent, which is consistent with the LSRA management strategies for Connectivity Habitat (LSRA p. 67). They will continue to function as dispersal habitat.

Marbled Murrelet:

The thinnings would not remove or degrade suitable habitat for the marbled murrelet. Total suitable habitat available to murrelets on federal land within the South Fork Coos River 5th Field Watershed is 10,108 acres (32%) and within the East Fork Coquille River 5th Field Watershed is 15,994 acres (35%). There are no known occupied murrelet stands within the Tioga Creek Subwatershed. The treatments would not negatively affect any constituent elements of Critical Habitat.

The Marbled Murrelet Recovery Plan (USFWS 1997) includes the use of silvicultural techniques such as thinning to increase the speed of development of new habitat. Task 3.2.1.3 states that thinning accelerates tree growth and can be used as a tool to produce large trees more quickly than in normal stand development. An action for the Siskiyou Coast Range Zone, which includes the Tioga Creek Subwatershed, is to decrease the time for development of new suitable habitat (p. 128, USFWS 1997). Grenier and Nelson (1997) concluded that murrelets use stands with old-growth characteristics and stand structure, and stand structure and characteristics are more important than stand age. Structures that were important at nest sites were high vertical canopy cover above the nest cup ($x = 78.9\%$), multi-layered canopies, large limbs, and trees greater than 127 cm in diameter (p. 200). Nests were located in large trees with large platforms and high vertical canopy cover. In general, the stands around the nest trees were open and the density of dominant trees was lower than at adjacent sites, which may facilitate access to the nest trees. Thinning can be used to create these types of stand structures and facilitate development of future murrelet nesting habitat by increasing tree and associated limb growth rates. Thinning may also allow murrelets to occupy these stands in a faster time period versus un-thinned stands that would assist in the species recovery.

Amphibians and Reptiles:

Only the clouded salamander and the western toad are likely to be affected by the proposed treatments. Tree falling, yarding and use of heavy equipment would damage some existing down logs that provide key thermal cover and foraging habitat for these species.

Mammals:

The special status mammal species described in the Section III would not be substantially affected by the proposed thinning.

Other birds:

Thinning would alter the stand density and canopy closure, and could make the thinned areas unsuitable for accipiter nesting habitat. Accipiters such as the Cooper's hawk select stands with high canopy closure and tree density, usually between 30 and 70 years of age, for nesting (Reynolds 1983), such as the proposed sale areas. These dense stands serve to protect both adults and young from predators, and provide shaded, relatively mild environments for the nest site (Reynolds 1983). There are no known Cooper's hawk nest sites within the proposed harvest units.

Thinning would increase understory shrub development. This would provide cover for neotropical migratory birds that are shrub nesters such as MacGillivray's warbler, orange-crowned warbler, and Swainson's thrush. Most units are within 0.25 miles of unsurveyed suitable habitat for the marbled murrelet and so would have seasonal restrictions for harvest activities. This restriction would also protect nesting songbirds in the proposed units. Hardwood forest associated species that nest close to the ground such as Wilson's warbler and Nashville warbler could be affected if alder conversion harvest activities occur during the nesting period. Thinning would change stand structure and understory vegetation, which would benefit other special status bird species. Thinning would increase tree crown depth and volume, would increase understory vegetation size vigor and diversity. Thinning would increase tree diameter growth resulting in greater bole surface area and increased bark furrowing. The net effect would be a greater and more diverse range of foraging substrate surface areas usable by several bird species (Weikel and Hayes 1997).

In the short term, thinning would not cause negative impacts to Survey and Manage wildlife species as discovery sites will be managed according to current approved management recommendations. In the long term, thinning would speed the development of late-successional stand characteristics that would have a positive impact on Survey and Manage Species.

General habitat and associated wildlife:

Of the approximate 3,742 acres of BLM land in the subwatershed in the closed sapling-pole-sawtimber stand condition, the proposed action would treat approximately 2,536 acres. Thinning can move stands out of the closed-canopy stage and accelerate development of conditions found in mature-seral forests. Some of the structural characteristics found to be lacking in young forests, but typical to older forests are large live trees, deep fissured bark, large-diameter snags, large-diameter logs, multi-canopy layers, including a well developed understory, and diverse tree species composition, especially the presence of hardwoods. Deep fissures in the bark, typical of old growth Douglas fir, would provide roosting sites for bats. Thinning would increase the abundance of some species of spiders and insects. Chipmunks and flying squirrels could increase, as captures were substantially higher for them in the post-treatment year following commercial thinning as compared to pre-treatment sampling in most of the stands studied (Anthony and Gomez 1995).

Numerous research projects have reported that thinning can promote late-successional conditions. Commercial thinning can be used to direct the development of large crowns on the dominate and co-dominate trees as it maintains large, live crowns in the overstory and favors establishment and growth of new conifers, shrubs and hardwoods (Fried et al. 1988). Thinnings in young stands can also shorten the time it takes to develop old-growth characteristics such as large trees (Newton and Cole 1987). Recent studies have found that growth patterns of trees in many old growth stands in the Coast Range developed with only 30 - 50 trees per acre (Tappeiner et al. 1997). This is in opposition to the high stand density found in many of our young stands. Densities between 30 and 50 tpa provided open canopies and good understory development (Emmingham 1997). Additionally, crown ratios and branch diameters are increased. Large crowns provide larger areas and nesting opportunities for many foraging and nesting birds like the marbled murrelet and habitat for the red tree vole. Nest sites of northern spotted owls (Forsman et al. 1984) and marbled murrelets (Nelson and Hamer 1995) are most abundant in stands with large-diameter trees.

The current stands have a high tree density and do not have much structural diversity or understory vegetation. Thinning would allow light to reach the forest floor and by that encouraging greater percent cover and species diversity in the herb and shrub layers. A more diverse understory would provide nesting, roosting, and foraging habitat for small birds and mammals, and would provide forage for big game.

The two main impacts on existing snags and down logs would be logging damage to the structures, and the reduced potential for future natural recruitment of small diameter snags and logs through suppression mortality. Logging injury to leave trees and other treatment related mortality could also recruit 1 to 2 new CWM and/ or snags per acre; however, this is not a reliable recruitment mechanism because the potential for mortality is also related to near term weather related stress and damage. The existing snags would be protected from cutting unless they pose a safety hazard. Though thinning would remove most of the suppressed trees that would become snags and logs under natural processes over the next 30 years, it would release the live trees so that they would attain larger dbh sizes in a shorter amount of time (20 inch dbh by stand age 50). A second entry for creation at that time would provide snags/down wood with a greater dbh that would decay slower through time.

A wildlife habitat concern with commercial thinning is that it produces an evenly spaced stand that is lacking diversity in its spatial arrangement and tree form. The combination of landscape prescriptions of coarse and fine textures for whole units, different spacing prescriptions including diameter limits with spacing overrides, gap creation, alder conversions, un-thinned riparian zones, un-thinned patches, and buffered Survey and Manage sites will provide uneven spacing and should lead the project to not “doing the same thing everywhere.” As the spacing prescriptions are on a unit basis, the result will not be homogenous over the landscape.

Thinning in Riparian Reserves would result in minor short-term impacts for long-term gains toward old-growth structural habitat. Thinning would remove those trees that would have died through suppression. However, the remaining trees would grow to larger diameters which would allow for larger snags and down wood over time, and would provide for more suitable wildlife habitat in the long term. It would take an un-thinned stand 200 years to develop forest structure and diversity (South Fork Coos Watershed Analysis, Ch. 14, Pg. 16). Under conventional thinning the stand would reach this stage at approximately 160 years with larger diameter trees than un-thinned stands. A second entry in the future, to provide additional growing space, recruit and insure survival of understory trees, and create additional snags, would further shorten that period.

The mix of ground-based, cable, and helicopter harvest systems should provide adequate habitat protection. For the cable system, the skyline corridors would not cause additional negative impacts to wildlife habitat (e.g. fragmentation, creation of gaps larger than the thinning prescription) as the corridors would only be a maximum of 12 feet wide. This would be less than any of the prescribed thinning spacings. In general, there are usually fewer roads and landing construction associated with helicopter logging. However the

road system is in existence for most of the proposed units, so new road construction would not be eliminated to any significant degree by helicopter logging all units. Ground disturbance would be minimized with the helicopter system. All harvest systems would follow the seasonal and/ or daily timing restrictions from the USFWS Biological Opinion so negative impacts from noise disturbance would not be an issue.

Alder Conversion

One management strategy in the LSRA (LSRA p. 69) is that treatments in adjacent stands should be carefully designed to maintain interior habitat conditions of late-successional stands. Alder conversions would not affect existing interior microclimate conditions within the upper canopy of adjacent late-successional stands in the near term as the alder is less than ½ site potential tree height. In the long term, replacing the alder with a conifer-dominated stand would decrease the microclimatic and habitat contrasts between the treated site and the adjacent stands. Alder conversion would result in an edge between the treated area and the adjacent stands, and the sharpness and gradient of the edge effect will depend on the stand characteristics of the adjacent unit (e.g. stands with deep crowned trees and a dense understory will experience less edge effect than stands with open understory and short crowns (Chen *et al.* 1995)). In the long term, the edge between the planted conifer stand and the adjacent older stand would become softer, less distinct, and more permeable to late-successional related wildlife species. If left untreated, the alder would eventually die out and the unit would become a salmonberry / brush field. This creates a strong edge, which is a less desirable condition for late-successional related wildlife species.

Alder conversion would have a beneficial affect on late-successional related wildlife species, including Special Status and Survey and Manage species, as it would restore the conifer component of the stand. In the long term, the planted stand would also contribute conifer snags and down wood that is more beneficial to wildlife and longer lasting than alder.

Burning for site preparation on the alder conversion units may affect northern spotted owls, marbled murrelets, neotropical migratory birds, and other wildlife as it could occur during the nesting season and could use equipment that would generate noise above ambient levels. There is also a risk that smoke may enter into the suitable stands. It would not be a significant negative effect as the recommended seasonal restrictions from the USFWS Biological Opinion would be applied when possible, the approximate 321 acres are scattered over several units, and smoke management plans would be applied that would decrease the risk of smoke drift into any adjacent suitable habitat.

Piling and burning would create less of an impact on down wood and snags verses broadcast burning as the piles can be placed away from these structures thus causing less charring. Burning can impact down logs by: bark charring, removal, or hardening; accelerated decay process; and removal of associated litter/sloughed bark. One of the most important features of decay class 1 and 2 down wood is that the bark is intact. The pattern under the bark provides valleys and pockets for small wildlife to occupy. The bark holds in moisture, which creates a suitable habitat for salamanders and invertebrates. If the bark is removed, or fire charred, the logs' water holding capacity and associated habitat characteristics would be diminished.

New Road Construction

There would be 3.5 miles of new construction that is mostly in the form of short spurs; and these roads would be decommissioned after use. The roads would not impact any known special wildlife habitats, or suitable habitat for owls or murrelets. There would be short term impacts from noise disturbance during construction and decommissioning. The Analysis File contains a table of road construction segments and their proximity to habitat for northern spotted owls and marbled murrelets. While the roads are open, wildlife could be impacted by human use of the road including increased vehicle use, poaching, direct injury, and general harassment. The roadbed would be a barrier to some wildlife species. As the roads would be closed after harvest, the negative impact of wildlife disturbance would be short term. As the roads would be semi-permanent and closed after harvest, they would not increase the long-term road density for this Tier 1 Key Watershed. See below for effects of decommissioning these new constructed roads.

Road Renovation/Improvement

Road renovation/ improvement of 35.0 miles would not impact any known special wildlife habitats (i.e., meadow, cave, wetland). Renovation would cause noise disturbance during renovation/ improvement and decommissioning. The Analysis File contains a table of road renovation/ improvement segments and their proximity to habitat for northern spotted owls and marbled murrelets. Renovating roads that are currently self-closed could increase human use of the roads and negatively impact wildlife through disturbance by vehicle use, poaching, direct injury, and general harassment. Survey and Manage species would not be impacted, as the road prism is not suitable habitat. Decommissioning the 11.6 miles of renovated/improved roads after the project would decrease the time that wildlife are disturbed by human use of these road segments. See below for additional effects of decommissioning these roads. The RMP road density goal for Federal land in the area is 1.1 miles per mile² per watershed. The current road density for

federal ownership in the Tioga Creek Subwatershed is 3.7 miles per mile² and the proposed road closures would bring the density to 3.2 miles per mile² per watershed.

Road Closure/Decommissioning

Decommissioning an additional 2.8 miles of road (non-project roads near identified road to be decommissioned) would further reduce the road density within the watershed to 3.1 miles per mile². Decommissioning would cause noise disturbance. The Analysis File contains a table of road decommissioning segments and their proximity to suitable habitat for northern spotted owls and marbled murrelets. In the short term, Survey and Manage species would not be impacted, as the road prism is not suitable habitat. There would be a positive effect on big game from reduced human disturbance and harassment. This would have a positive affect on people who prefer to hunt behind closed road systems, and a negative affect on those who prefer to use roads while hunting. There seems to be general hunter acceptance of closures as management tools (Lyon and Ward 1982). Closing the roads would also have a positive effect by reducing the possible mortality/injury of individuals. Reestablishing vegetation growth within the road prism would benefit wildlife species by decreasing the edge and barrier effect of roads, and reconnecting the terrestrial habitat. The road surface is a physical barrier to small-bodied, ground-dwelling wildlife such as small mammals, and mollusks (Bennett 1991 in Gibbs 1998). Roads also cause direct mortality. Fahrig et al. (1995) reported that the density of frogs and toads decreased due to direct mortality from increased traffic intensity. Small wildlife species may not cross a roadbed, even if it is closed to vehicles, due to the change in surrounding conditions (Noss and Cooperrider 1994). This is supported by Gibbs (1998) who reported that amphibians are more likely to move across a forest-early-seral land edge than across a forest-road edge.

Rock Quarries

Project Design Features in this EA incorporate the appropriate seasonal and daily timing restrictions from the U.S. Fish and Wildlife Service Biological Opinion (2000) for northern spotted owls and marbled murrelets. This would minimize the potential of noise disturbance to these species from quarry activities. Blasting for quarry rock could remove existing bat roosting habitat, but it could also create habitat if additional crevices are formed. The quarries would not be considered habitat for red tree voles as the quarries have already been disturbed and there would be no removal of trees.

Snag Creation

Snag creation in the proposed units would increase snag numbers for those primary cavity excavators that can use snags 15" diameter and greater in size. As snags would be created from trees in the middle diameter size class, snag creation would not take the dominant live trees from the stand so the stand would continue to grow towards late-successional characteristics. Management implications from Weikel and Hayes (1997) stated that rather than create snags from small-diameter trees that it may be more effective to grow trees to larger diameters before creating snags, as cavity-nesting birds in the Coast Range select large-diameter snags for nesting when they are available. In the study, thinning young stands did not negatively impact the abundance of cavity-nesting birds and provided an opportunity to enhance habitat for these species. The additional snags would increase the amount of foraging sites for woodpeckers and nesting habitat for some of the smaller woodpeckers and secondary cavity nesting birds. It would also create potential roosting sites for bats. As these snags fall and become down logs, they would provide input of new down log habitat important for the terrestrial amphibians such as the clouded salamander, and a variety of small mammals preyed upon by northern pygmy and northern saw-whet owls. Not creating snags in the rest of the stands would not impact wildlife that use snags as the units met the snag guidelines in the Late-Successional Reserve Assessment as analyzed in the Appendix D of this EA.

Coarse Woody Material Creation

Down wood creation in the proposed units would increase current decay class 1 and 2 amounts and benefit wildlife species that use down wood. The structures would serve as foraging, nesting, cover and dispersal habitat for a variety of small mammals and amphibians. A further discussion of coarse woody material is in the Appendix D of this EA.

In-Stream Restoration

Down wood is currently lacking in the areas proposed for in-stream projects. Positive impacts would include the placement of downed wood in the active stream channel and within the riparian zone. For example, logs that span the stream would provide travel pathways for furbearers and small mammals. The downed logs would provide foraging and resting areas for birds, mammals, amphibians, and reptiles. The in-stream structures would also benefit crustaceans, snails and insects. There is a risk of direct mortality of herptiles by machines, equipment, or in-stream project work. Short-term stream habitat alterations could also occur. Amphibians and reptiles rely on the aquatic and/or riparian system for some part of their life stage. Sedimentation during the projects

could impact herptiles that are directly downstream, however this would be a short-term impact, and no long-term or cumulative negative impacts should occur.

Cumulative Effects

There are no expected cumulative significant negative impacts associated with the Proposed Action for any wildlife species. While density management and alder conversion would alter forest structure, they would not result in the complete loss of habitat for wildlife species listed in the Affected Environment Section.

Thinning should speed the attainment of late-successional characteristics in the treated stands (South Fork Coos Watershed Analysis, Ch.14). Stands thinned to 60 tpa with a subsequent snag treatment at age 60, should attain many old-growth attributes by stand age 100 to 150. In addition, the stands should average 20-inch dbh by age 50. Stands thinned to 120 tpa should attain many attributes used to define old growth by stand age 160. However, a low to moderate severity disturbance would need to occur to attain the multi-canopy, multi-age characteristics. If left untreated, the majority of the stands would be approximately 200 years of age before they develop the forest structure and diversity of a late-seral stand. Some of these stands contain such high stocking levels that they would not attain the late-seral stand characteristics if left untreated.

An estimated 508 acres in the LSR that were either too young to treat or deferred for other reasons may be proposed for density management in the future. If left untreated, the majority of the younger and untreated stands in the subwatershed would continue to move towards late-successional characteristics. All stands in the Late-Successional Reserve/Riparian Reserve land use allocation of the subwatershed would reach or exceed 80 years of age by year 2085 assuming the last alder conversion in this package was completed in 2005.

The BLM administers 64 percent of the Tioga Creek Subwatershed, but the subwatershed is bordered on the east by a very large block of private timber lands. Most of the lands in this area were harvested in the 1960s or 1970s. Both public and private lands in this area, are dominated by, vegetatively and structurally simplified young second growth plantations (0-50 year old.) In the General Forest Management Area portion of the subwatershed, late-seral forest habitat is limited to small patches and riparian stringers. Private timber companies would be expected to continue intensively managing their forestlands on short 40-60 year rotation cycles for the foreseeable future in a manner consistent with Oregon Forest Practices Regulations, and in the case of Weyerhaeuser, consistent with an agreed upon 1995 Habitat Conservation Plan.

The cumulative impact to wildlife species is that density management and the associated projects in the Tioga Creek Subwatershed would produce stand structure and components associated with late-successional conditions, including large trees, snags, down logs, and variable-density, multi-storied, multi-species stands (RMP ROD p. E-7). This would speed the development of and increase the amount of late-successional habitat available in the subwatershed.

Fisheries - Aquatic Habitats/Riparian Habitats, Including Special Status Fish - No Action

Riparian zones comprise the interface between terrestrial and aquatic ecosystems. The amount and condition of in-stream habitat features that benefit fish and aquatic life can be directly linked to several key habitat related functions of riparian zones and riparian vegetation. These functions include but are not limited to shading, streambank stabilization, controlling sediment movement, contributing coarse woody material, and contributing/retaining organic litter (Spence et al 1996). Since approximately 58% of the acres treated will come from the Riparian Reserve under the proposed alternative, the focus of this analysis will be on the impact management treatments will have on these 5 riparian related functions and their present and future contribution to the habitat and function of the aquatic system.

The condition of these riparian zone features directly influence habitat and function of fish bearing streams. They also have an influence on reaches of intermittent and ephemeral streams throughout the sub-basin.

Design features, set to reduce or eliminate possible impacts to riparian function, aquatic habitat and fish, and water quality, are established for all management actions capable of physically disturbing these habitats. Implementation of all design features and Resource Management Plan directed Best Management Practices will decrease the chances of direct and indirect impacts to these habitats and their associated species.

Special Status Species - Fish

Implementation of "No Action" will not alter existing landscape features and will not result in any direct or indirect measurable impact to any life stage of federally listed Oregon Coast coho salmon; federal candidate Oregon Coast steelhead and Oregon Coast

cutthroat trout; or the “special status” Pacific lamprey and Millicoma dace. This includes both negative and positive, short term or long term impact on fish or critical habitat.

Aquatic Habitat/Fisheries Habitat

Foregoing thinning would produce the highest numbers of future down logs in the riparian zone and stream channels through suppression mortality. This down wood is small in diameter (units average is 13 inches in diameter) and provides limited durable structure for in-channel functions. They would provide limited structure to larger downstream fish bearing channels in the event of natural hillslope processes such as landslides and debris avalanches.

Large relic logs that were left on site in riparian zones and streams will decompose long before being replaced by coarse woody debris of equal size. The stand trajectory, including the Riparian Reserves, set by “No Action” will result in a delay in attaining late-successional characteristics and therefore the attainment of new coarse woody debris by many decades.

The present dense canopy closure provides considerable shading to perennial streams and aquatic habitat. These untreated units will continue to provide conditions that maintain high quality cold water to on-site streams, which is then available to downstream fish bearing streams. Many of the 1st to 3rd order streams will continue to function at risk, in part due a deficiency of large durable coarse woody debris for in-channel structure and function. In the long term, however, dense second growth stands in Riparian Reserves would continue to grow at a slower rate than if thinned. This would result in unfavorable height to diameter ratios, which increases the risk of blowdown and subsequent exposure of the stream to solar heating (Wilson; Oliver (2000)). In addition, the un-thinned condition would delay establishment of understory trees and shrubs with their associated multi-canopy layers that could provide shade in the event that some or all of the overstory shade is lost due to a catastrophic event (Levno; Rothacher 1969 cited in Adams; Ringer 1994).

No direct management related benefits would occur above existing background levels. Riparian zone and in-stream restoration would be passive. Naturally occurring hillslope and streamside processes would continue to provide structural components to stream channels in irregular pulses. The long-term positive benefits that result from the attainment of old growth forest habitat characteristics through the management thinning of approximately 1,665 acres of Riparian Reserve would be significantly delayed. Riparian forest stands that range up to 720 trees per acre, if left untreated, would remain suppressed for decades and could not provide the large size coarse woody material required to attain proper functioning conditions of riparian zones or aquatic habitats that would lead to healthy salmonid populations.

In-stream Restoration

Direct, short and long term positive impacts to stream function, and aquatic/fishery habitat would not occur as a result of forgoing in-stream habitat restoration. Up to 1.0 mile of proposed in-stream habitat restoration projects for Burnt Creek, Beaver Slide Creek, West Fork Tioga Creek, and Tioga Creek would not be accomplished. Approximately 8 miles of stream channel would not receive direct input of coarse woody material in the form of whole trees to be cut and dropped into and over stream channels at a proposed average of 1 tree per 100 feet of stream. In addition, the potential for an unknown amount of sediment resulting from in-stream placement of logs as coarse woody material and cutting and dropping whole trees as coarse woody material input on streambanks would not occur.

Riparian Functions - Shading

Without thinning or catastrophic natural events, stream channel canopy cover would continue in a nearly closed state for several decades. Very little reduction in canopy cover would occur as dominant overstory trees out compete sub-dominants. Overstory crowns would eventually expand while suppression mortality creates some holes in the canopy. There would be a significant delay of several decades in the development of a diverse forest structure in Douglas-fir dominated riparian stands. The development of an understory shrub layer, which can be an important shade component of 1st to 3rd order streams, would also be significantly delayed. Stream water temperature would be maintained at ambient levels through these units.

Tree canopy cover, in alder dominated streamside stands would in time decline to zero as the alder stands senesces and breakup leaving the riparian zones dominated by a salmonberry and other shrubs. On very small streams (approximately 3' or less wide) adequate shade could be provided by overhanging shrubs to maintain cool water temperatures, but on larger streams sunlight could reach the channel and raise water temperatures. The development of an overstory canopy composed of shade tolerant cedar and hemlock would be extremely slow to develop, if at all. These sites may not be capable of maintaining ambient water temperatures at some time in the future.

Streambank stabilization

The root system of streambank trees contributes to binding and holding bank soils and floodplain substrate in place. The effective extent of the root mass and root strength of streambank trees reaches to approximately one-half tree crown diameter. Streambank trees within one-half crown width distance from the stream are the primary contributors to streambank stability in the absence of an understory shrub layer.

Douglas-fir tree dominated stands of high density and narrow crown diameter will maintain good streambank stability. Since light is limited in these stands, understory plant cover and the root systems they provide, will be minimal. Alder dominated streambanks have an adequate amount of light penetration to form a dense understory and ground cover. Streambanks in this condition will likely have good stability.

Since no streambank trees will be impacted under the “No Action” alternative, current streambank stability and bank erosion rates will be maintained on all channels through the units.

Controlling sediment movement

Sediment movement across the forest floor for non-channelized sediment will remain negligible under the “No Action” alternative. These dense Douglas-fir stands have minimal forest floor vegetation but the dense forest litter and high porosity prevent sediment movement. The tight canopy cover will help intercept and reduce the energy produced by heavy rains that could mobilize soil particles. Channel functions related to sediment sorting and storage processes in the subwatershed rely on the presence of coarse woody debris. The small diameter of suppression mortality derived coarse woody debris will provide some sediment control but for a limited duration.

On a landscape level, this subwatershed would not receive the benefits of improved hydrologic function through the decommissioning of 11.6 miles of road within this Tier 1 Key Watershed.

Hardwood dominated sites will have significant forest floor vegetation and dense forest litter that will reduce rainfall energy and function to intercept the movement of sediment across the forest floor. Fallen trees and leaf and branch litter reaching the channel can function to retain sediment.

Contributing coarse woody debris

The present rate of delivery of coarse woody debris to the stream channel and riparian zone will not be affected under the “No Action” alternative. Without thinning, the rate of delivery to both the stream channel and the riparian zone will also remain constant in most units unless catastrophic delivery occurs. The average tree size across all proposed thinning units is 13 inches in diameter and would remain small for many decades. Suppression mortality, especially with in the proposed units with the highest tree densities, will continue to be a source of small coarse woody material delivery to the riparian zone and stream channels.

The average condition of coarse woody debris in these stands is inadequate to provide in-stream structure. A downed tree may have been standing dead for many years before falling and will be in a state of advanced decomposition when it reaches the ground or stream channel. It will likely break into short, less functional lengths upon falling. In most small streams, a live blowdown tree averaging 13 inches in diameter will provide some structural function to the riparian zone and channel, however durability is considerably less than a large conifer log. Attainment of “key” piece size wood for delivery to the riparian zone and stream channel, through natural mortality, is unlikely before the stand reaches nearly 200 years old.

In alder dominated stands, salmonberry brush fields will dominate as red alder matures and dies. Under disturbance free conditions, few conifer trees will become established in these salmonberry brush fields. The attainment of “key piece” size in the riparian zone and in-channel CWM is not expected from these sites.

Contributing organic litter

Most organic litter contribution to the stream channel and riparian zone occurs from one half tree height away from the stream. Un-thinned stands with high tree density will contribute the highest amounts of organic litter, in the short term, through high competition mortality. The rate and amount of organic litter recruited to the stream channel and riparian zone will be maintained under the “No Action” alternative. In conifer dominated stands the litter is mainly composed of needles, twigs, and branches and is contributed throughout the year. In hardwood dominated stands, organic litter is composed of leaf and twig matter and is delivered seasonally.

Fisheries -Impacts on Aquatic Habitats/Riparian Habitats, Including Special Status Fish - Proposed Action

Density Management

The proposed thinning units adjacent to fish bearing streams, while inside the Riparian Reserve, are in all cases outside of the riparian zone. The riparian zone is highly influenced by the presence of water. Because of this, the riparian zone functions differently from the rest of the Riparian Reserve that consists of transitional and upland habitats. Riparian zones are common to the inner gorge and will be protected within established no harvest buffer widths.

Special Status Species - Fish

The proposed action will not negatively impact critical habitat or any life stage of federally listed Oregon Coast coho salmon or “special status” Oregon Coast steelhead. No coho or steelhead bearing streams will occur in these units. Established design features and best management practices will minimize impacts to riparian zone functions and aquatic habitats and prevent measurable amounts of sediment movement off-site to coho and steelhead bearing streams or to downstream coho and steelhead stream critical habitat. See Table F 1 - Appendix F for Evaluation Criteria and Effects Determination for Tioga Density Management Units.

Long term cumulative benefits are expected within the subwatershed as Late-Successional Reserve characteristics are obtained and expanded. This desired future condition within the Late-Successional Reserve will contribute toward proper functioning conditions of riparian and aquatic ecosystems. Additional Riparian Reserve activities, planned or occurring within the Tioga Creek subwatershed, will contribute to proper functioning conditions of riparian and aquatic ecosystems. Additional in-stream restoration efforts are expected to continue on both public and private lands. Populations of listed and special status fishes in Tioga Creek are expected to at least be maintained near present levels in the future as a result of long term cumulative actions in the subwatershed.

Stream Shading

There is no risk of a rise in water temperature from the proposed forest management on these 1st to 3rd order streams. Thinning will maintain an average minimum canopy cover of 60% throughout the thinned portion of the Riparian Reserve. This canopy will provide enough shade and cover to bolster the effectiveness of the 20 foot no-harvest buffer in providing the shade necessary to maintain ambient stream water temperature. Topographic features would provide additional stream shade across many of the units and understory vegetation.

The thinning units that contain or are adjacent to known fish bearing streams currently have an average tree height of about 90 feet and an average of 270 trees per acre. Fish bearing streams are generally larger and present a slightly greater risk of elevating stream water temperature through forest management than do smaller 1st to 3rd order stream channels. The risk exists due to the potential of increasing direct sunlight to the stream surface. The potential to elevate water temperature will be significantly reduced by providing a variable no-harvest buffer width to be determined by a staff specialist depending on stream size, aspect, existing vegetation, and local topography. An average minimum canopy cover of 60% or greater would remain in the thinned portion of these riparian zones adjacent to the buffer. This 60% canopy cover would bolster the effectiveness of the variable width no-harvest buffer. As a result of applying design features that maintain high canopy cover levels, there likely will be little to no reduction of the shade necessary to maintain ambient stream water temperatures on any fish-bearing stream.

No-harvest areas established are intended to function as stream protection buffers to reduce or avoid impacts to aquatic resources from harvest activities. These buffers would also assist in maintaining stream integrity, which includes vegetation composition, shading, and bank stability.

On the smaller streams, an increase in side light penetration may benefit the development of minor tree and shrub species in the riparian zone or at streamside. Overhanging streamside tree and shrub development will add additional shade to these channels.

Streambank Stabilization

Streambank stability will not be reduced because of the implementation of the no-harvest stream buffers.

Controlling Sediment Movement

Using Best Management Practices that minimize exposing mineral soil on steep slopes and implementing no-harvest buffers for stream channels, would prevent soil mobilization across the forest floor to streams. Fish and fish habitat will not be impacted by the density management activities within the proposed projects.

Contributing Coarse Woody Material

The “mechanisms” of delivery of coarse woody material to stream channels and riparian zones will not be affected under the “Proposed Action” alternative. With density management based thinning from below and the implementation of the variable width no-harvest stream buffers, the “rate” of coarse woody material delivery to both the stream channel and the riparian zone may be reduced. There will be a reduction in the total number of trees available for recruitment to the riparian zone from the thinned areas. However, with added time to grow, these thinned units will attain a larger size tree at a faster rate, and trees that die in the thinned stands would have larger average diameters than trees that die in a similar aged unthinned stands. Competition mortality will continue to occur from the interior of the buffer and provide down wood. The present average tree size across all units is 13 inches in diameter. The rate of delivery to the stream channel and riparian zone from the trees in the lower crown/size classes would increase over the short term. Surviving trees from the interior of the buffers will remain suppressed and retain a small size for many decades.

Attainment of a “key” piece size log for delivery to the stream channel and the riparian zone as a result of natural mortality from the un-thinned buffer is unlikely before the stand reaches 190-200 years old. A 20 inch or greater diameter sized tree would be obtainable from the thinned Riparian Reserve 10-20 years after the treatment of a 40 year old stand. Random mortality on thinned sites will produce a 24 inch newly dead tree anywhere from age 70 to 160 depending on thinning treatment and site potential.

A smaller stream will derive functional benefits from a smaller average “key” piece size log. Sediment routing and storage, surface and ground water retention, energy dissipation, and channel complexity can be obtained from a steady supply of down wood created through suppression mortality in small 1st and 2nd order streams. The no-harvest buffer can supply these trees to the riparian zone. A slower rate of recruitment of larger size trees will occur from the thinned areas. Restoring large wood (loading) to these “delivery” streams is an important component of the Aquatic Conservation Strategy and future restoration of aquatic and fishery habitat and stream functions.

Organic Litter

In the short term, contribution of organic litter to the riparian zone and channel may be reduced from the area outside of no-harvest buffers along non-fish bearing streams due to the loss of harvested trees. In the long term an increase in tree and branch growth, and understory shrub growth may increase the amount and diversity of organic litter available in the riparian zone and stream channel. On fish bearing streams, with a variable width no-harvest buffer, no measurable reduction in delivery of organic litter to streams is expected to occur.

Within the no-harvest buffer widths, suppression mortality is expected to continue. In the long term, shrubs will contribute diversity to the organic litter component and diversity to the invertebrates that process this material. In riparian zones dominated by hardwoods, leaf litter, as well as twigs, branches, and cones will continue to be provided to the stream channel.

Alder Conversions

Stream Shading

There is a slightly higher risk of affecting stream temperature from an alder conversion than a thinning. The treatment involves cutting and removing all alder in order to apply silvicultural methods to ensure re-establishment of conifer trees. Most sites have scattered conifer trees that will be retained and can provide some site shade. All streams in units where alder conversion treatments are to be applied will receive a minimum 20-foot no-harvest buffer; the no-harvest buffer could be expanded on a site-specific basis to provide additional protection. Resource area staff based on stream size, aspect, existing vegetation, and local topography would determine the width needed to provide adequate stream shading. This variable width no-harvest buffer can equal approximately 30% to 50% of the existing tree height. The alder canopies within these buffers would provide shade above the channels. In addition, under typical hardwood a dominated condition, a dense shrub and herbaceous understory cover exists which provides a high degree of the shade and cool microclimate over smaller stream channels. Many of these alder conversion units have topographic shading. Unit 15h contains a length, approx. 3,800 ft., of perennial stream occupied with resident cutthroat trout that, if exposed to direct sunlight, could possibly result in a measurable elevation of stream temperature. Red alder and a number of healthy understory conifer provide nearly a 100% canopy cover over this stream. Some increase in side lighting is expected on this stream that is approximately 1.25 miles above a barrier to anadromous fish and the closest downstream coho salmon habitat. Ambient water temperature in this stream has not been measured but is likely similar to an adjacent stream which measured in the low 50's F.

Streambank Stabilization

There is an extremely low risk of reducing streambank stability on any stream channel from the proposed forest management actions within these units. No streambank trees are proposed to be cut as a result of the specific alder conversion treatments, therefore streambank stability is likely to remain at present levels.

Controlling Sediment Movement

Under typical hardwood dominated conditions, a dense shrub and herbaceous understory exists as well as thick duff layering. This will provide sediment filtering if exposed soil is present in these units. It is unlikely that soil will reach stream channels through the buffers on alder conversion units.

Contributing Coarse Woody Debris

Alder conversion is an appropriate vegetative treatment on conifer sites disturbed by previous forest management. On these red alder dominated sites, salmonberry brushfields can result when the red alder dies. Disturbance free conditions on these sites will likely result in little to no conifer or red alder establishment in these salmonberry brush fields. Large red alder can function as coarse woody material in stream channels or riparian zones, but for a much shorter time period than conifer. A red alder log can shatter into short pieces when it falls and will decay much more rapidly than a conifer log of the same size. Submerged red alder will last slightly longer as coarse woody material, however, average channel size and water depth precludes continuous wetting of most fallen red alder. It is desirable to replace red alder with longer lasting, more durable, conifer species on appropriate sites within the Riparian Reserves and the riparian zone. Without re-establishment of streamside conifer, hillslope processes will become the primary source of coarse woody material recruitment to stream channels. Mature conifer trees adjacent to the riparian zone are a more reliable source of coarse woody material than the less frequent debris flow events.

It is necessary to provide growing space for successful conifer re-establishment. All streams in units where alder conversion treatments are to be applied will receive a minimum 20-foot no-harvest buffer. Cutting all the red alders on the conversion sites would reduce the amount of red alders seeding back and by that reduce the risk of losing the conifer regeneration to light competition. However, variable the width buffer next to streams is an important design feature for protecting the stream and riparian zone functions in the interim until the regenerated conifers are large enough to meet those needs, especially next to fish bearing streams. The existing coarse woody material can provide some channel function during reestablishment of conifers. Suppressed conifer trees within these units will benefit from release. However, most of these conifers are small, and a few are just reaching a height that tops the existing red alder. Once released, these suppressed trees have a size advantage over planted conifer, but would unlikely provide key piece sized coarse woody material in the short term. Some existing dominant and codominant conifers are widely spaced and could contribute coarse woody material in the short term.

Organic Litter

In hardwood dominated stands, organic litter is composed of leaf and twig matter from the overstory trees as well as the understory shrub component. In alder conversion stands, a reduction of leaf and twig matter may be expected in the riparian zone over the short term because of the reduction of the number of trees. Short term stand maintenance will reduce litter production by shrubs and hardwoods, but will ensure that nearly all of production is converted to litter. Litter production by shrubs would decline as the conifer stand enters the stem exclusion stage of stand development, but would increase following thinning or another disturbance that opens the overstory canopy.

Litter, directly contributed to the stream channel, may only be slightly reduced in the short term. The buffer, composed of hardwoods and understory shrubs, will contribute litter directly to the stream for the life of the hardwoods. The shrub layer at streamside could persist and contribute litter after the red alder have been eliminated. In the long term on small channels, canopy closure will reduce light and reduce leaf litter contributions but increase needle, twig and cone contributions.

Yarding Corridors

Stream crossing yarding corridors would be used to avoid the environmental and economic costs of building the additional roads that otherwise would be needed to access both sides of all streams. In some locations, cable tail holds on the opposite side of streams from the landings, as well as intermediate supports, would be needed to obtain the full log suspension desired to protect soils, and stream banks.

An estimated 98,000 feet of non-fish bearing stream channel is contained within all units and approximately 166 yarding corridors over these stream channels will be needed to thin those units. This will create approximately 1,992 feet (2%) of overstory gap over an estimated 98,000 feet of ephemeral, intermittent, and perennial stream channel. Approximately 6,200 feet of fish bearing stream channel (all resident cutthroat) is contained within harvest units and will require 11 yarding corridors over these stream channels. Approximately 132 feet of overstory gap (2% of 6,200 feet) will be created over non-anadromous fish bearing stream channel. Design features requires the yarding corridors widths remain small, # 12 feet in width, less than the spacing requirement for the thinning prescription, and corridors will be widely spaced across stream channels. It is unlikely that individual corridor gaps will reduce stream shade enough to raise ambient water temperatures. Cumulatively, there will be one yarding corridor per 563 lineal feet of fish bearing stream, and one yarding corridor per 589 lineal feet of all streams. Unit 15a will average the shortest distance between corridors on non-fish bearing channel at 133 feet (3 corridors over 400 feet of channel) while unit 15h will average the shortest distance between corridors on a fish-bearing channel at 345 feet (11 corridors over 3,800 feet of channel or 3.4% of the channel).

Stream Shading

Yarding will be accomplished by cable yarding logs uphill away from stream channels to established landings or general roadside landings. Cut-to-length ground-based harvesting and helicopter harvest systems will not require stream crossing corridors. Each cable yarding corridor (up to 12 feet wide) will create a small gap within the overstory canopy. Individual gaps may allow sunlight to penetrate to the stream channel for short periods of the day during the summer season. Corridor trees cut from the no-harvest buffer will be dropped on or over the stream channel and left on site. These trees will provide short term shade over the stream, as well as structure for stream functions, and cover habitat if on fish bearing stream channels. These overstory gaps will also be partially shaded by topographic features and the no-harvest buffer trees.

Partially shaded sunlight reaching 2% of all stream channels within these management units will not measurably raise ambient water temperatures in individual streams within the Tioga Creek watershed.

Streambank Stabilization

Where cable yarding occurs through no-harvest buffers, logs will be fully suspended to protect streambanks. Trees cut from the stream crossing corridors will be dropped on or over the stream channel and left on site. These trees cut from the no-harvest buffers will act to armor streambanks, minimize streambank erosion, and provide coarse woody debris. Where full suspension is not feasible over intermittent or ephemeral channels, yarding will occur during the dry season.

Controlling Sediment Movement

Very little exposed soil and soil mobilization is expected as a result of the creation and use of yarding corridors in riparian zones. Corridors in riparian zones that do not require stream crossings will have no mechanism to directly contribute sediment to stream channels because of the filtering capacity of the no-harvest streamside buffer. No direct, indirect, or cumulative impact to fish and aquatic life or their habitat is expected.

Corridors in riparian zones that do require stream crossings will have the trees cut from within the no-harvest buffer area left on the site to act as mechanical ground armoring and sediment filtering devices. These trees, as well as the duff layer they protect, will be very effective at intercepting soil that may be mobilized as a result of yarding logs. No soil is expected to directly enter a fish bearing stream as a result of using yarding corridors. Full log suspension is required where a crossing corridor is needed over a fish bearing stream. This would avoid creating avenues for sediment delivery to the channels. No direct impact to fish and aquatic life or their habitat is expected. Corridors over non-fish bearing streams will not deliver sediment to channels.

Contributing Coarse Woody Material

Coarse woody material will be slightly increased in the short term on approximately 2,200 feet of stream channel as a result of the design that requires corridor trees to be cut and left on site. Trees will be dropped toward the stream channel when cut. Over the long term, coarse woody material recruitment potential may be slightly reduced due to the cutting of corridor trees that could reach stream channels. Trees on the edge of corridor gaps may slightly benefit from additional light the gaps provide and may potentially contribute a larger tree as stream channel or riparian zone structure in the future.

Organic Litter

Yarding corridors will immediately contribute organic litter to stream channels and riparian zones in the short term as a result of corridors trees being cut and left on site. Yarding corridors may reduce streamside trees by 2% over all of the proposed units. These

trees will be unavailable to contribute litter over time as a result of being cut. Corridors will however, increase light levels which then increase growth of edge trees and understory shrubs to produce and contribute organic litter over time.

Road Construction/Improvement/Renovation/Haul Routes

A total of 48.4 miles of road construction, renovation, improvement, or decommissioning is proposed. No new road construction will occur in Riparian Reserves. A small number of riparian trees may need to be removed as a result of road renovation, improvements or decommissioning actions including, replacing or removing culverts, at stream channel crossings.

Stream Shading

No measurable reduction in stream shade or increase in water temperature is expected from these actions. No reduction of riparian zone vegetation or stream shade is expected along haul routes. Ambient stream water temperature in streams crossing or paralleling haul route roads will not be effected.

Streambank Stabilization

Design features and BMP's are established to minimize streambank erosion and stabilize streambanks at road and stream intersections. No reduction of riparian zone vegetation or loss of streambank stability will occur as a result of the construction or use of any haul routes.

Controlling Sediment Movement

Design features and BMP's are established to minimize streambank erosion and stabilize streambanks at road and stream intersections. Applying the design features and BMP's will prevent sediment from entering stream channels where road renovation, improvement, or decommissioning actions occur at stream crossings.

No sediment will enter stream channels as a result of the construction or use of any haul routes. Primary haul routes are all paved roads. Secondary haul routes are generally well-maintained gravel, all weather roads or will be upgraded to this status. Applying design features and BMP's will prevent sediment from entering stream channels when improvements occur on haul routes.

Under all situations, if burning is associated with hardwood conversion, it can only be done inside of the Riparian Reserves if there is no potential to deliver soil/sediment to a stream channel. Burning of debris piles within riparian zones would be permitted only if there is no potential for sediment delivery to stream channels. Machine piling will be permitted within the Riparian Reserve only where it will not contribute to soil compaction that exceeds 12%. A hydrologist or fishery biologist should be included in determining whether and where to burn within Riparian Reserves.

Contributing Coarse Woody Material

Proposed actions are confined to the road prism or clearing limits of new construction. There is no opportunity for the coarse woody material along roads to contribute to stream habitat.

Organic Litter

A small number of riparian trees may need to be removed as a result of road renovation, improvements or decommissioning actions including replacing or removing culverts. No measurable reduction of organic litter production or contribution to stream channels or riparian zones is expected as a result of road management actions

In-Stream Restoration - Coarse Woody Material Placement

Coarse woody material already present in these stream channels will continue to provide habitat structure and diversity for channel maintenance functions. The proposed action of adding approximately 1 tree per 100 feet of stream over approximately 8 miles of streams would result in a net increase of coarse woody material. In addition, trees cut at stream crossing corridors will contribute toward channel maintenance and function. Many of these channels are downcut and the placement of cut trees on the channel may result in spanner logs over the streams. When cut trees do reach these small stream channels, stream flow could be deflected to cause a slight amount of bank erosion on poorly vegetated streambanks. On reaches of exposed streambank a small amount of bank erosion is expected near cut trees but the sediment/turbidity derived from flow deflection should be transported only a short distance downstream before being sorted and deposited by in-channel processes at downstream structure. No sediment is expected to reach

downstream to areas of coho and steelhead critical habitat. The placement of whole cut trees to selected streams will be determined on the ground by the area's fisheries biologist or area hydrologist.

Up to 1.0 mile of in-stream habitat restoration is proposed for Burnt Creek, Beaver Slide Creek, West Fork Tioga Creek, and Tioga Creek. Logs, in the larger diameter classes, from adjacent thinning units would be placed in these streams as small accumulations of logs similar to naturally formed logjams. Logs could be placed by helicopter or cable yarded into place.

If this in-channel habitat restoration action occurs, no fish will directly be killed as a result of log placement. Juvenile coho and steelhead could be present at these sites and could indirectly be disturbed and displaced during log placement but are not expected to be harmed. Turbidity would increase and a small amount of channel sediment would be displaced and move downstream as a result of log jam building. No sediment is expected to be added to the channel however resident sediment is expected to be displaced and sorted as it travels a short distance downstream. Recovery to pre-placement water clarity is expected within a few hours of project completion.

A variety of existing in-channel structures have been placed in these streams over the past several years. Cumulatively these structures have collected gravel for spawning, created pool habitats and provided cover for fish. Log jam building in critical habitat for coho will complement the effectiveness of existing structures while endeavoring to meet the structural complexity required by the multitude of aquatic species, including listed fish, found at these sites. Fish populations are expected to respond favorably to this restoration project over the long term from increased substrate and litter retention, creation of pools and cover complexity, and improved channel functions including higher water table and floodplain connectivity.

Soils - No Action

Direct, Indirect, and Cumulative

This alternative would have minimal impact on existing soil conditions. No additional disturbance would occur to soils not already affected by historic activity. Likewise, no reclamation of currently compromised soils would occur. The project proposes the decommissioning of existing roads, allowing for the improvement of hydraulic permeability, reduction of compacted area, and reclamation of historically impacted soils. The proposed decommissioning will also reduce access to motor vehicles which may also cause the disruption of soils and erosion controlling vegetation, allowing for mobilization of sediments to the waterways. Under this alternative none of these actions will be taken.

Soils - Proposed Action

Direct, Indirect, and Cumulative

Approximately 3.5 miles of new road construction is proposed under these timber sales. The longest segment of road for construction is 0.6 miles. All of the construction will be for temporary spur roads that will be decommissioned within a year after harvest operations are complete. Some soil erosion from cut bank sloughing and from the road surface can be expected, especially from heavy rains during the first winter following construction, harvest and site preparation activities. It is not anticipated that these sediments would enter the streams. The new spurs are located on ridge tops. Therefore, erosion and sedimentation would be non-existent due to the small drainage area and the fact that no headwalls initiate at the top of the ridges where the roads are located. Surface erosion generated during the harvest, road and landing construction would migrate very short distances before being filtered by duff and woody materials. Seeding and mulching of the bare soils would minimize the impacts created by road and landing construction. Renovation of existing roads would consist of roadside brushing, reshaping, and restoring the surface where necessary, maintaining or improving drainage structures, and applying rock surface where needed. Rock would be obtained from the following quarries: Buck Peak Quarry (T.27S., R.9W., sec. 10), Elk Wallow Quarry (T.27 S., R.9W., sec. 14), Burnt Mountain Quarry (T.27S., R.9W., sec. 24).

Installing water bars and removal of any culverts should be included as part of the decommissioning after harvest activities. Subsoiling would be of little or no benefit in restoring hydrologic function on ridge top roadway systems due to the very small amounts of surface runoff. At present, the upper six inches of old skid roads within the timber sale units have mostly recovered from previous timber sale activity. On the old skid trails, trees have begun to seed in and a duff layer of ½" to 1½" has developed on the surface. Below six inches, partial to moderated compaction is still present. Subsoiling of the old skid roads is not recommended because of the potential for residual root damage to occur to the trees that have grown adjacent to the skid trails. The old skid roads, through natural processes, have sufficiently recovered to the extent that subsoiling may disturb these processes. After completion of harvest operations, native surface roads will be ripped to a depth of at least 6 inches and mulched and seeded with an approved seed mix.

Previous studies have found that forests often contain root grafting, a natural occurrence which links root systems of several trees into one functioning community. In Douglas-fir, 45% of selectively cut trees were found to be root grafted, and half of these were still actively growing 22 years after harvesting. Root grafts also can have importance in stability and wind-throw, girdling, and between-tree competition (Daniels, et al, 1979). Roots provide cohesion to soil and therefore, strength that is independent of the natural friction angle of the soil (Forest Service, 1991). Within these Tioga Creek thinnings, residual root strength from the retained trees and the grafted roots of trees cut during harvest should maintain slope stability. Through the use of Best Management Practices such as stream buffers, sediment would not be expected to reach the streams.

This alternative will meet the Best Management Practices, as described in the Coos Bay District Record of Decision and Resource Management Plan, Appendix D, Conservation Practices for Timber Harvest. Paragraph 8 of the BMP for Ground-based Yarding Systems states that:

“... a. If tractors or rubber-tired skidders are used for log skidding, skid trails will be designated with the objective of having less than 12 percent of a harvest area affected by compaction. Existing skid roads will be used to the extent practical...”

Based on historical aerial photography, existing road and skidder compaction has been estimated. This is based on the measurement of the trail system length and an assumption of 12-foot width for compaction. The assumption being derived from field observation of ground-based harvest operations by BLM personnel. This estimated amount of existing compaction, calculated from previous timber management operations, is presented in Table 9. Future compaction from yarding activities will be very localized and difficult to predict. As directed by the ROD/RMP BMPs, Appendix D, previously used skid trails will be use for present and future entries. Therefore, if previous access routes are used and new roads created are completely decommissioned, it is anticipated that there would be no net increase in the total area of compaction. However, if new access routes are required, they will be limited so to not exceed the 12 percent compacted area threshold. If more access is required than allowable by the 12 percent threshold, existing compaction would need to be obliterated concurrent with other harvest operations. Table 9 projects the estimated amount of compaction allowable per unit for new skid road construction.

Table 9 - Compaction Summary

UNIT	EXISTING COMPACTION OF UNIT (%)	ADDITIONAL ALLOWABLE COMPACTION FROM TIMBER SALE (%)
15a	6.88%	5.12%
15g	3.11%	8.89%
16	6.28%	5.72%
22b	9.05%	2.95%
23	1.79%	10.21%

The ground-based units (15a, 15g, 16, 22b, and 23) were analyzed for historic areas of compaction via historic aerial photography. These units have been cat-logged in the past and contain slopes gentler than 35%.

According to Allen (1997), the use of slash under ground-based equipment does not eliminate compaction. However, studies have shown that such techniques may reduce the degree and depth of compaction. Allen (1997) further states that existing compacted routes are not further compacted by additional passes of equipment.

Hydrology - No Action

Stream Flow

Flow timing and magnitude would remain unaffected by the no action alternative because no thinning or density management would occur and none of the proposed road renovation or decommissioning projects would be implemented. Annual yield, low flows, and peak flows will be unaffected by maintaining present forest conditions. However, roads proposed in the project for renovation or decommissioning would continue to potentially affect the magnitude and timing of stream flows due to their capacity to extend the drainage network (see Chapter 4 Hydrology –Proposed Action - New Road Construction - Stream Flow,page56). Riparian areas dominated by stands of alder will potentially continue to reduce low summer flows (see Chapter 4 –Hydrology – Proposed Action _ Alder Conversion/Site Preparation/Planting - Stream Flow, page 55)

Water Quality

Stream Temperature

Stream temperatures on Tioga Creek and other streams in the proposed project area would not be affected in the short term. Riparian shade will continue to increase on those reaches that have not yet reached or matured to their potential condition. In the long term, however, dense second growth stands in Riparian Reserves would continue to grow at a slower rate than if thinned. This would result in unfavorable height to diameter ratios that increase the risk of blowdown (Smith 1962, p. 422) and subsequent exposure of the stream to solar heating. In addition, the un-thinned condition would delay establishment of understory trees and shrubs with their associated multi-canopy layers that could provide shade in the event that some or all of the overstory shade is lost due to a catastrophic event (Levno; Rothacher 1969 cited in Adams; Ringer 1994). Lowered summer flows from dense stands of alder in riparian areas would potentially continue to contribute to elevated summer temperatures (see Chapter 3 -Hydrology - Water Quality - Stream Temperature, page 26).

Sediment

There would be no short-term soil displacement and sediment delivery to streams as a result of the no action alternative. Over the long term, existing roads identified as potentially having an adverse affect on water quality would not be renovated or decommissioned at this time. Some roads proposed for renovation or decommissioning would continue to have the potential to increase fine sediment delivery to stream channels (see Chapter 3 -Hydrology - Water Quality - Sediment, page 26).

Channel Condition and Large Wood

Growth of trees in Riparian Reserves in the proposed project area would continue; however, the trees in dense second growth stands would grow at a slower rate than if thinned due to competition for sunlight, nutrients and water. Future recruitment of large wood in terms of amounts, longevity and functional capabilities may be delayed due to reduced growth in overstocked riparian stands. Without thinning it would take years longer for large wood to be available for interaction with the streams. Riparian areas dominated by alder would continue to prevent growth of conifers that could potentially contribute large durable wood to stream channels. Large wood is a critical element for maintaining proper channel function (see below Hydrology-Proposed Action - Density Management - Channel Condition and Large Wood).

Hydrology - Proposed Action

Density Management

Including Riparian Reserves, approximately 2,536 acres of dense, second growth stands in the Late-Successional Reserve land use allocation would be thinned as a result of the proposed project. The Coos Bay District RMP ROD states that thinning of stands should be used to “create and maintain late-successional forest conditions...” (RMP ROD p. 19). Approximately 1,665 acres of Riparian Reserves would be thinned in order to meet both Aquatic Conservation Strategy Objectives and development of late-successional forest habitat. The Aquatic Conservation Strategy is a portion of the Northwest Forest Plan developed to restore and maintain the ecological health of watersheds and aquatic ecosystems on public lands. The Coos Bay District RMP ROD states that we should “Apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives” (RMP ROD p. 13).

The thinning units under this proposed action are well distributed throughout all of the four major drainages in the Tioga Creek subwatershed. These drainages and their approximate thinning areas are listed in the table below. Approximately 16.2% of BLM lands or 10.3% of the total subwatershed lands would be thinned.

Table 10- Location of Thinning Areas by Drainage (approximate values from GIS data)

Drainage	Total Acres	Thinning Acres	% of Total
Lower Tioga Creek	8,967	953	10.6
Middle Tioga Creek	7,081	726	10.3
Burnt Creek	2,919	478	16.4
Upper Tioga Creek	5,688	393	6.9

Stream Flow

Annual Yield

Forested areas on the Coos Bay District use large amounts of water to satisfy evapotranspiration demands. It is common in western Oregon for evapotranspiration to be in excess of 25" annually. However, site conditions determine how much evapotranspiration will actually occur, and depends on slope, aspect, soils, type of vegetation and climatic conditions. A 1979 study by Harr in western Oregon showed annual water yield increases to be in the range of 8-25" for a regeneration harvest. The largest increases in annual water yield occur in the fall and spring, when maximum differences in water storage exist (Harr, 1976). Estimates of potential water yield increases from large forested watersheds are in the range of 3-6%, assuming the use of 70-100 year rotation intervals (Harr 1983). Additionally, Harr (1979) found that the regrowth of shrubs and small trees commonly returns rates of evapotranspiration to pre-logging levels within about five years, while Keppeler and Ziemer (1990) and Ziemer et al. (1996) found that water yields returned to near pre-logging condition within a range of 1-8 years following harvests.

Much of the research on the affects of timber harvest on water yield was done by studying the affects of harvesting entire small watersheds and involved treatments that went from ridge top to creek edge. Little research has been done in the Pacific Northwest looking at the affects of partial cuts, thinnings, patch cuts or the affect of clearcutting while retaining streamside buffers, on water yields. However, an average annual yield of 2.4 inches was detected for four years after a shelterwood cut, where 50% of the basal area was removed from a southwest Oregon Cascades watershed. A patchcut watershed, which had 20 small clearcuts totaling 30% of the watershed resulted in an average water yield increase of 3.5 inches (Harr et al. 1979 cited in Reiter and Beschta 1995). Where individual trees or small groups of trees are harvested, the remaining trees will generally use any increased soil moisture that becomes available following timber harvest. Because of such "edge effects" light shelterwood cuts and thinnings are expected to have little effect on annual water yields.

Low Flows

Low flows may initially increase following timber harvest in the analysis area, but the effect is short lived (5-10 years). In addition the absolute difference in additional quantities of stream flow is small (Harr and Krygier, 1972, Hall et al. 1987), and may even be beneficial to fish during the summer when temperatures are high and flows are lowest. Vegetation left in place through the use of buffer strips can use additional upslope water as stated above. Over time baseflows can actually decrease if more consumptive riparian species occupy near stream areas (Hicks et al., 1991). This condition may be occurring presently; due to the high density of alder in riparian areas.

Peak and Extreme Flows

No measurable changes in peak flows are expected as a result of the proposed project. Extreme peak flows in the low elevation Coast Range, are dependant on climatic patterns rather than vegetation manipulation. Based on measurements from clear-cut harvest, peak flows during fall and spring periods are likely to be increased primarily due to reductions in transpiration and interception losses following harvest (Jackson and Van Haveren 1984 cited in Reiter and Beschta 1995). However, fall and spring peak flows are generally considerably smaller than the larger peak flows that typically occur during large storms in midwinter.

In Tioga Creek, peak flows are predominantly generated by rainfall events. This is because nearly all of Tioga Creek watershed is located within the rain-dominated elevations below the transient snow accumulation zone. In a literature review comparing studies of nine rain-dominated coastal streams, eight showed an increase in peak flows following harvest and one showed a decrease. In over half of these studies winter peak flows increased, and the smaller fall and spring peak flows increased in eight of the nine studies. The magnitude of change range from a -36% to a +200% (Reiter, 1995.) These studies considered only small drainages (30-1000 acres), and did not consider timing and synchronization or desynchronization effects as water routes through larger main stem streams. These studies did not consider the distribution of harvest units throughout the watershed. In three of these studies, the peak flow increases were not statistically significant.

The transient snow zone (TSZ) is defined as land between 2000 and 5000 feet in elevation. Higher than normal peak flows can occur as a result of warm, rain on snow events in the TSZ (Harr and Coffin, 1992). Timber harvest can provide openings where snow accumulates. Warm rain-on-snow events can melt this increased snow pack quickly and create higher than normal flows. Just under half of the proposed harvest areas contain some acreage within the transient rain-on-snow elevation zone. About 800 acres of planned units, or 3.2% of the Tioga Creek subwatershed, lie above 1,800 feet in elevation. This additional area is minor and would have little measurable effect on flood discharge, should the right set of climatic circumstances occur.

Water Quality

Stream Temperature

Shade from trees near the stream channel is important for reducing direct solar radiation and therefore stream temperatures (see Chapter 3 Hydrology - Water Quality - Stream Temperature, page 26). Thinning in Riparian Reserves increases the chance of impacting stream temperature by temporarily increasing openings in the canopy and reducing shade. However, the proposed project incorporates design features to minimize canopy openings. These include no-harvest buffers adjacent to streams to maintain the canopy directly over channels, retaining a minimum of about 60 trees/acre outside no-harvest buffers and minimizing the number and size of cable yarding corridors.

A variable width no-harvest buffer would be established around all streams. There would be a no-harvest buffer within 20 feet of a stream bank or unstable area near the bank, within 20 feet of the top of the inner gorge, within 20 feet of the floodplain, or within 20 feet of the outer edge of streamside riparian vegetation, whichever is greater. The no-harvest buffer could be expanded on a site-specific basis to provide additional protection, such as fish bearing streams, unstable areas, and alder conversion units. Resource area staff based on stream size, aspect, existing vegetation, and local topography would determine the widths needed to provide adequate stream shading.

In general, canopy closure in the thinned areas outside no-harvest buffers would be maintained at 60% or above. It is estimated that canopy closure would approach pre-thinning density in about 10 years. The increased growth rate of trees released by the proposed density management will result in larger trees in a shorter time period than would occur without thinning. The reduced height to diameter ratios in thinned stands would make the stands more robust with respect to resisting catastrophic blowdown and canopy loss. The understory canopy, which develops in response to the increased light levels created by thinning, will provide redundant layers of shade in case of overstory tree mortality. The no-treatment strips next to the streams would maintain the pre-treatment level of canopy closure directly above the streams. Due to these design features stream shading would be maintained, and the proposed density management would not adversely affect stream temperatures.

Sediment

Some short-term soil displacement may occur as a result of localized disturbance from felling, yarding, and ground-based equipment operations. Incorporation of project design features, including no-harvest areas as described above, would prevent delivery of sediment to streams. These buffers would also assist in maintaining streamside vegetation composition, shading, and bank stability. The no-harvest areas would provide an adequate filter strip and would prevent delivery of sediment to water resources in the short term. In the long term, large wood contributed to the stream channel as a result of density management has the potential to create additional capacity for sediment storage (see below Channel Condition and Large Wood).

Cable yarding across stream channels has the potential to disturb stream banks and increase sediment delivery to the stream. However, design features for cable yarding would minimize this potential. There should be no measurable increase in sediment because most yarded logs will be fully suspended and would not contact stream banks. In the few cases where full suspension is not feasible, trees felled across the channel and left in the no-harvest buffer would provide bank armoring.

Channel Condition and Large Wood

Density management in Riparian Reserves would increase tree growth rates in the area most likely to contribute large wood to stream channels (FEMAT 1993, pp. V-26&27). Thinning second growth stands located within the Riparian Reserves ensures greater growth and tree size in a shorter time period than would occur without thinning. Faster growth rates are due to an increase of available light, nutrients and water for the remaining trees. This should allow the trees within the Riparian Reserves to develop at a rate consistent with the thinned upland stands. Restricting thinning of second growth stands in the Riparian Reserves would create a situation where the largest trees are furthest from the stream channel with less chance of interacting with the stream.

Large wood recruitment is an integral part of watershed recovery and restoration of aquatic habitat (see fisheries report). Large wood delivered to the channel from Riparian Reserves would provide several benefits to channel function and water quality. Large wood can serve to capture substrate, aggrade the stream channel, re-establish a connection with the floodplain and reduce stream energy. Aggradations of the channel due to large wood also have the potential to raise the water table, increase floodplain water storage and increase summer stream flows. Increased summer flows would contribute to lower stream temperatures (see Chapter 3 Hydrology - Water Quality - Stream Temperature, page 26).

Density management in Riparian Reserves would benefit intermittent as well as perennial streams. One purpose of Riparian Reserves is to maintain the structure and function of intermittent streams (NFP ROD p. B-13). Research showed as much as 15 times the annual sediment yield stored behind wood in Idaho streams and between 100 to 150 years of average annual bedload stored behind wood debris in steep tributary streams in northern California (Megahan 1982; Keller et al. 1995, both cited in Curran 1999). A recent study by Curran (1999) found that spill resistance from step-pool reaches contributed 90% of the friction that slows water velocity in some western Washington headwater streams. This has the potential to delay flow from these tributaries during storm events and reduce peak flows downstream. All large wood currently on the ground and in the channels would be retained.

Alder Conversion / Site Preparation / Planting

Conversion units are well distributed throughout all of the 4 four drainages in the Tioga Creek subwatershed. These drainages and their respective thinning areas are listed in the following table.

Table 12 - Location of Alder Conversion Areas by Drainage (approximate values from GIS data)

Drainage	Total Acres	Thinning Acres	% of Total
Lower Tioga Creek	8,967	58	0.6
Middle Tioga Creek	7,081	174	2.5
Burnt Creek	2,919	10	0.3
Upper Tioga Creek	5,688	66	1.2

Stream Flow

The effects of proposed alder conversion on stream flow would be similar to those discussed under density management above. However the following differences between treatments would apply. In theory, conversion of alder stands to conifer would increase stream flow in summer since conifers are believed to transpire less water than hardwoods during the summer growing season. A paired watershed study by Hicks et al. (1991) indicated hardwoods that re-grew in the riparian area after logging used more water in summer than conifers. August flows 3-18 years after harvest were 25% lower than pre-harvest levels.

Just under half of the proposed unit areas contain some acreage within the transient rain-on-snow elevation zone. About 110 acres of planned conversion units, or 0.4% of the Tioga Creek subwatershed, lie above 1,800 feet in elevation. This additional area is extremely small in comparison to overall watershed area and would have little measurable effect on flood discharge, should the right set of rain-on-snow circumstances occur.

Water Quality

The effects of proposed alder conversion on water quality would be similar to those discussed under density management above. However, conversion of alder to conifer stands has the additional potential to increase summer low flows. Increased stream flow in summer would help reduce stream temperatures during the most critical period, although, changes at the 6th field subwatershed level would probably not be measurable. Taller conifers in the riparian area would be more effective than alder in providing shade for wider stream channels and would also help reduce stream temperatures.

The no-harvest buffer width adjacent to streams in red alder conversion units would be adjusted on a site-specific basis. Resource area specialists would determine the buffer widths needed to provide adequate stream shading based on stream size, aspect and local topography. Therefore, there should be little reduction in shade and no measurable increase in stream temperature as a result of the proposed alder conversion next to streams.

Channel Condition and Large Wood

As discussed previously (see Chapter 4 - Hydrology - Proposed Action - Density Management - Channel Condition and Large Wood page 54), large wood is a critical component for stream function and aquatic habitat in the proposed project area. Smaller hardwoods dominate most of the riparian zone surveyed by ODFW in the project area. Conversion of alder stands to conifer in riparian and upland areas will create the potential for future recruitment of large wood to stream channels.

New Road Construction

Approximately 3.5 miles of new road would be constructed to access the proposed units. All of these roads would be located on or near ridge tops. Road construction would incorporate design features to minimize erosion and sediment transport. These BMPs (RMP ROD p. D3, D4) may include but are not limited to avoiding fragile or unstable areas, minimizing excavation and height of cuts, and construction during the dry season. All newly constructed roads will be decommissioned when logging operations are completed.

Stream Flow

Forest roads have the potential to increase peak flows (Beschta 1978, Wemple et al. 1996). Roads with cut banks have the potential to intercept subsurface water and divert it into the road drainage network. Roads can serve to extend the drainage network and can increase peak flows by delivering water from their ditch lines to stream channels faster than in a non-roaded landscape. The proposed new roads would have a negligible effect on flow because they would be located on or near ridge tops and will be designed to stay disconnected from the drainage network. Ridge top roads have a low potential for diverting flows. The construction practices noted above will encourage drainage from the road surface to re-infiltrate and not connect or add to drainage from the existing road system. This will eliminate the likelihood of a potential change in the magnitude or timing of stream flow.

Roads have also been shown to increase peak flows when more than 12% of a watershed is occupied by roads or are compacted (Harr, 1976). However, roads in Tioga Creek occupy only about 2.3% of the subwatershed and the cumulative effect of compacted area created by the proposed roads would not cause measurable increases in peak flow. Again, these temporary spur roads would be constructed, used for harvest and decommissioned when logging is completed, returning them to a pre-disturbance hydrologic condition.

Water Quality

Roads have the potential to increase sediment delivery to stream channels. However, Reid and Dunne (1984) and others found that the amount of sediment produced by a road is highly dependent on the location, amount of use, surface type and other factors. They measured 130 times as much sediment coming from a heavily used road compared with an abandoned road, and a paved road yielded less than 1% as much sediment as a heavily used gravel road. It is also important to note that the roads must be hydrologically connected to a stream channel in order to deliver sediment-laden runoff. Heavily used roads with poor surfaces that are adjacent to a stream channel have the highest capacity to deliver sediment and reduce water quality.

As noted above, the 3.5 miles of proposed new roads are located on or near ridge tops and will not be directly connected to the drainage network by ditch lines. Any sediment-laden surface water should quickly infiltrate into forest soils. All new construction, dirt roads and landings would be seasonally maintained prior to winter rains if to be used the following year. Seasonal maintenance may include but is not limited to providing adequate water bars, mulching at a minimum of 2000 lbs. per acre using wood chips or straw and seeding with a district approved erosion control seed mix. Therefore, the roads and landings should not increase sediment delivery to stream channels and would have little potential to affect water quality.

Road Renovation/Improvement

Approximately 35 miles of road associated with the proposed density management would be renovated as a result of the project. BMPs that would be used for the proposed road renovation may include but is not limited to surfacing with rock, improving stream crossings, correcting erosion problems from ditch lines and cross drains, restoring outslope or crown sections, and stabilizing cut banks and fill slopes. These improvements would minimize sediment production and potential water quality degradation from the existing roads.

Road Closure/Decommissioning

Approximately 9.9 miles of existing road would be renovated/improved and used and decommissioned at completion of proposed project activities. Decommissioning of these road sections would reduce their potential to alter flow magnitude and timing and their potential to deliver sediment to stream channels

In-Stream Restoration and Culvert Replacement and Upgrading

Impacts associated with in-stream log placement throughout the project area will have a positive long-term effect on water resources. Additions of large woody to previously 'cleaned' and/or wood deficient streams will add complexity to stream channels where none

presently exists. Placement of log jams and single pieces of wood will act to trap gravels moving downstream narrowing and deepening streams that are presently bedrock.

Replacement or upgrading fish passage culverts within the project area will also have a positive effect on water resources within the Tioga Creek subwatershed. Replacement of existing pipes with larger culverts will reduce stream velocities on the downstream ends of these culvert pipes. Elevated stream velocities due to undersized culverts can lead to increased bank and bed scour, serving as a chronic source of fine sediments that can degrade water quality and aquatic habitats.

Prescribed Burning / Slash Pile Burning for Understory Development

Proposed prescribed burning of appropriate units and slash piles should have no adverse effect on water resources. Amount and intensity of burned areas will be minimal, with replanting and in-place buffers capable of trapping any sedimentation or nutrients capable of being transported to water resources.

Haul Routes

The majority of the gravel-surface portions of the haul routes is under private control and used extensively during logging operations by private timber companies. Use by non-timber company employees also is common during hunting and fishing seasons in the fall and winter. Most of the haul routes are located on ridge-top with few stream crossings, and where stream crossings do occur, the ditch lines are generally well vegetated with no indications of sediment delivery. Several intermittent and perennial streams stream crossings were located, through field inspection that showed minor signs of sediment delivery during heavy rainfalls.

Sediment delivery to streams as a result of hauling federal timber would be prevented through the use of silt fencing and/or straw bail barriers, removal and/or relocation of trapped sediment to stable upland areas, gravel lifts to stream crossings, and dry season hauling. Dry seasonal haul restrictions will be applied to: 1) Natural surface haul routes over streams with sensitive fish species, 2) Natural surface haul routes over perennial streams that flow into fish bearing streams.

The private landowners who control the roads along the haul route would be contacted by the BLM to request permission to place bales of straw or other sediment control devices where sediment delivery is likely to occur. Location of these sediment traps will be pointed out to the awarded contractor so that these structures may be in place before any haul can occur during the rainy season.

Consistency with Aquatic Conservation Strategy Objectives

The Aquatic Conservation Strategy (ACS) was developed to restore and maintain the ecological health of watershed and aquatic ecosystems contained within them on public lands. The strategy would protect salmon and steelhead habitat on federal lands managed by the Forest Service and Bureau of Land Management within the range of Pacific Ocean anadromy (ROD, Standards and Guidelines, p. B-9). The appropriate landscape scale for evaluating the consistency of individual and groups of projects with the ACS is the watershed, corresponding with the “fifth-field” hydrologic unit code (HUC) as defined in the “Federal Guide for Ecosystem Analysis at the Watershed Scale”⁵The proposed projects are all within the South Fork Coos 5th Field Watershed (Hydrological Unit Code# 1710030401).

The intent of the ACS is to maintain and restore aquatic habitats and the watershed functions and processes within the natural disturbance regime by prohibiting activities that retard or prevent attainment of ACS objectives. The primary emphasis of the Standards and Guidelines for Riparian Reserves is restoration of the ecological processes and stream habitats that support riparian dependant organisms.

This conservation strategy employs several tactics to approach the goal of maintaining the “natural” disturbance regime, but it is not possible to provide for the complete recovery of aquatic systems on federal lands within the range of the northern spotted owl within the next 100 years, and full recovery may take as long as 200 years.

ACS OBJECTIVE 1 - Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.

The project involves commercial thinning and alder conversions on Matrix and Riparian Reserve land use allocations (LUAs). Measures would be taken when implementing the projects to assure the maintenance and restoration of watershed and landscape

⁵ Reference November 9, 1999 Regional Ecosystem Office memorandum concerning Northwest Forest Plan Requirements for ACS consistency determination.

features as described in the Project Design Features section of this EA. Coarse wood and snags would be retained in the project units and additional down wood would be provided at yarding corridors and along all stream channels (one tree would be felled for every 100' of stream length within each unit). The increased spacing created by thinning would release minor conifer species, thereby increasing overall stand diversity and providing long-term habitat for riparian and aquatic-dependent species (Tappeiner 1999). The development of larger trees and a diverse understory is expected to provide greater benefits to more species (Chan et al. 1997).

No road construction or timber harvest would occur within Riparian Reserves that would be likely to degrade the aquatic systems. Because all new road construction would be temporary and additional existing roads would be decommissioned following project completion, road density in the project area would be decreased in the long-term. The provision of yarding corridors through Riparian Reserves would result in only minor gaps in the overstory canopy and not degrade the Riparian Reserve (ie. the Riparian Reserve system would continue to provide adequate shade, woody debris recruitment, and habitat protection and connectivity). The design features proposed for the projects are expected to maintain the elements outlined in ACS Objective 1.

ACS OBJECTIVE 2 - Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

No new roads or culverts would obstruct routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species. The density management thinning and alder conversion projects would retain the dominant conifer in both the Riparian Reserves and upland areas, and spatial and temporal connectivity would be maintained (canopy closure post-thinning would be a minimum of 60% in the thinned stands).

The proposed projects would meet the objectives stated in the Coos Bay District Record of Decision and Resource Management Plan of having less than 12% compaction within the harvested areas. Use of ground-based logging systems would be limited to broad, gently sloping upland areas. Some localized soil displacement and soil compaction can be expected, but would not likely affect riparian areas. No net increase in compaction is expected from ground-based logging methods, and the existing condition in regards to compaction will be maintained. No known refugia would be affected by the proposed projects. The proposed action is consistent with ACS Objective 2.

ACS OBJECTIVE 3 - Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

The physical integrity of the aquatic systems, in the vicinity of the proposed treatment areas, would be maintained by the Riparian Reserve network. Incorporation of design features described above would avoid impacts to stream bank and existing bottom configurations. Where thinning and alder conversions occur within Riparian Reserves, a minimum of 20 foot no-harvest buffers would be maintained along all stream channels, and the trees within the buffers would remain on site. Full suspension of logs would occur over stream channels where possible, and if not, yarding operations would be restricted to the dry seasons.

Ground-based logging systems in the density management thinning stands would occur on broad, gently-sloping ridgetops well outside of riparian areas. The design features for the project would maintain the elements outlined in ACS Objective 3.

ACS OBJECTIVE 4 - Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

The proposed projects are not likely to have a measurable effect on water temperatures or turbidity levels, or result in the release of hazardous materials. The no-harvest buffers, retention of the dominant trees, and post-thinning canopy closure of at least 60% should be sufficient to prevent temperature impacts. Full-log suspension over non-fish bearing streams would prevent damage to streambanks such that no erosion or sedimentation would occur during wet periods of the year. Where full log suspension is not feasible, one-end suspension would be required and yarding would be limited to the dry season. If haul occurs on gravel-surface roads during the wet seasons, sediment filters would be located to prevent road-generated sediment from entering aquatic and riparian habitats. Road related construction and improvement work involving earth-moving equipment would be accomplished during the summer months.

Refueling of gas or diesel-powered machinery will not occur in close proximity to stream channels. The contractor would be required to have a hazardous materials action plan to contain and clean-up any spills. Mechanisms would be in place to respond quickly to the incident to avoid contamination of a waterway. The design features incorporated with the proposed action are expected to maintain the elements outlined in ACS Objective 4.

ACS OBJECTIVE 5 - Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Implementation of Best Management Practices (Coos Bay District RMP 1994) and project design features should prevent any measurable increases in turbidity and fine sediment levels outside of the natural range of variability (see discussion for ACS Objective #4 above). Design features will minimize or eliminate road generated sediment delivery to streams along the gravel surface portions of the haul routes. Design features should also prevent sedimentation or turbidity increases that would measurably affect the sediment regime during replacement of culverts on small streams. Density management would maintain continuous forest cover and its associated root strength in resisting slope failure (Burroughs & Thomas 1977; Stout 1956 cited in Oliver & Larson 1990). Portions of the project areas considered at high landslide risk would be protected as part of the Riparian Reserve network, and would not influence the timing, volume, rate or character of landslide events. The elements outlined in ACS Objective 5 would be maintained.

ACS OBJECTIVE 6 - Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

The hydrology of the area is driven by precipitation in the form of rain. The area may occasionally receive snow, but the quantity and duration of the snow does not normally produce rain-on-snow events. The projects would affect the hydrology of the streams and tributaries within the project areas for a period of 15-30 years; minor increases in the annual yield, low flows, and the spring and fall peak flows are expected due to the increase in the amount of water available because of the removal of vegetation and the corresponding reduction in evapo-transpiration losses during the spring and fall. However, these increased spring and fall peaks are still considerably smaller than the peaks that typically occur during large winter storms. Therefore, the increase in peak flows would not have a detrimental effect, and increases in annual and low flows may be beneficial because more water would be available during the critical low flow season. Peak, summer, and annual flows are expected to remain within the range of natural variability for these stream types at both the 5th field and site level scales.

The proposed alder conversion could potentially increase low flows in summer. As noted above, a decrease in evapotranspiration from vegetation removal makes more water available for stream flow. In the long term, reestablished conifer stands would continue to use less water than alder (Hicks et al. 1991). However, any increase in low flows would probably not be measurable at the scale of this analysis.

ACS OBJECTIVE 7 - Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

The proposed action would maintain the current Riparian Reserve network on federally administered lands. The timing, magnitude, variability and duration of floodplain inundation will be maintained in the short- and long-term at both the site and 5th field watershed scales. Areas that are not currently connected with the floodplain would likely remain disconnected in the short-term and possibly in the long-term. No change in the current flow regime outside the range of natural variability is anticipated (see ACS Objective #6). Recruitment of large wood can serve to capture substrate, aggrade the stream channel, re-establish a connection with the floodplain and reduce stream energy. This has the potential to stabilize the stream channel and reduce bank erosion. Aggradations of the channel due to large wood also has the potential to raise the water table, increase floodplain water storage and increase summer stream flows.

ACS OBJECTIVE 8 - Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

The current Riparian Reserve network would be maintained on BLM administered lands. The proposed action would not alter any streamside vegetation that would be expected to influence stream temperature at the site or 5th field watershed scales in the short- or long-term. Thinning in the Riparian Reserves would release minor conifer species, increase overall stand diversity, and provide shading and surface litter. The development of larger trees and a diverse understory is also expected to provide greater benefits to more species (Emmingham & Hibbs 1997; Weikel & Hayes 1997). By maintaining the Riparian Reserve network, adequate summer

and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, channel migration, and coarse woody debris recruitment are expected to be maintained on federal lands. No wetlands occur within the proposed harvest units.

ACS OBJECTIVE 9 - Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

On a broad scale, the NFP provides for the maintenance and restoration of habitat to support well distributed populations of riparian-dependent species, primarily through the Late-Successional Reserve and Riparian Reserve networks. Other NFP components that further contribute to this goal include designation of Key Watersheds, mitigation measures for Survey and Manage Species, maintaining 15% of all watersheds in late-successional forest condition, retaining 25-30% late-successional forest in Connectivity blocks and retention of northern spotted owl 100 acre core areas and marbled murrelet occupied sites in Matrix lands

The proposed action would maintain all NFP land use allocations and management standards within the North Fork Coquille River watershed, including the Riparian Reserve network. This would result in the protection of habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species in the short- and long-term. The proposed project would be consistent with the elements of ACS Objective 9

Botany - No Action

Without harvest, stands proposed for density management will continue to follow successional stages that are typical well-stocked and over-stocked forests in the western hemlock vegetation zone. Without harvest, stands proposed for alder conversion will likely become salmonberry-dominated brushfields with a few shade tolerant emergent conifers such as western hemlock and western red cedar. There would be no effect to Survey and Manage or Special Status botany species from the no action alternative.

Botany - Proposed Action

Density Management

Direct: Thinning will disturb the existing terrestrial bryophyte layer. The resulting additional sunlight and exposure will dry this layer faster than pre-harvest conditions. Opening the canopy will allow air to circulate more freely, leading to better dispersal of epiphytic lichens. Some herbaceous species and epiphytes may have reduced vigor from the altering of the microclimate, while some species of herbs and shrubs will flourish from the increased sunlight.

Indirect: Thinning of the overstory canopy would result in short term, 5-8 years, changes in microclimate for plants and fungi; increasing light and decreasing relative humidities. The diversity and cover of shrub and herbaceous species is expected to increase in the years following thinning although this effect would be expected to also dissipate as tree canopies expand in the overstory. Thinning will change the stand development trajectory. There may be a decrease in small woody debris from capturing the mortality of the suppressed trees. Small woody debris decomposes too quickly to be habitat for any but the weediest bryophytes, such as feather moss (*Eurynchium oregonum*). Variations in the overstory densities would result in a variation in light levels on the forest floor. This would result in differences in species composition abundance and diversity in the understory. Understory vegetation response and multi-layered canopy development would be greater in the areas of the stands where lower retained overstory tree densities occur, due to the increased light to the forest floor.

Cumulative: Cumulative impacts on known sites of botanical species would be minimal. The known populations would be given long term protection because of the managed known site area buffers established around each site. There is a slight risk that some loss of individuals could occur, due to being undetected during surveying. However, there is substantial similar habitat provided by other reserves in the watershed. It is unlikely that exposing some percentage of potential habitats to management actions would compromise the persistence of Survey and Manage or Special Status species potentially occurring in the project area.

The proposed action would contribute to the long term development of diverse habitat for botanical species associated with mature forests by maintaining and promoting the development of species diversity; structural and spatial diversity; and canopy layering with the watershed. The proposed action would accelerate the development of large trees to provide future large snags and down wood, which would provide habitat for a variety of species. The proposed action would contribute to maintaining and restoring habitat to support well distributed populations of native plants. Species composition and structural diversity of plant communities would be restored within the watershed. Thinning may increase total cryptogam biomass by decreasing the amount of stands in the stem exclusion stage and of the doghair hemlock stage. These types of stands are generally very cryptogam-poor.

Alder Conversion

Direct: Removal of the trees in an alder conversion will remove a large amount of biomass in the form of epiphytic lichens and bryophytes. Herbs and shrubs will go from a fairly shaded condition to nearly full sun. The effect of additional sun and heat, as well as ground disturbance from logging, will cause some mortality to vascular plants as well as cryptogams.

Indirect: Removal of alder will change the species composition of these sites from species that inhabit hardwoods to those that grow on conifers. This change will be most apparent in the composition and abundance of epiphytic lichens and bryophytes. Herb and shrub composition should remain relatively unchanged.

Cumulative: Cumulative impacts on known sites of botanical species would be minimal. The known populations would be given long term protection because of the managed known site area buffers established around each site.

Road Construction

Direct: Road construction eliminates potential habitat for Survey and Manage or Special Status species.

Indirect: Construction of a road may change air currents through a stand and alter the patterns of spore/seed dispersal of Survey and Manage or Special Status species. Additional light and air movement in the stand adjacent to the road may alter the microclimate, which may alter species composition adjacent to the road.

Cumulative: Even though the roads are decommissioned, the road bed will remain reducing the area that is potential Survey and Manage or Special Status species habitat.

Road Renovation/Improvement/Maintenance

Direct: There is no direct effect to Survey and Manage or Special Status species due to road improvement as the road is already in a state of non-suitable habitat.

Indirect: Removing roadside trees during improvement may change air currents through a stand and alter the patterns of spore/seed dispersal of Survey and Manage or Special Status species. Additional light and air movement in the stand adjacent to the road may alter the microclimate, which may alter species composition adjacent to the road.

Cumulative: No cumulative effects are expected from the proposed action.

Road Closure/Decommission

Direct: There is no direct effect to Survey and Manage or Special Status species due to road closure as the road is already in a non-suitable habitat state.

Indirect: If the roads are ripped and replanted with tree species, they may eventually become habitat for Survey and Manage or Special Status species.

Cumulative: No cumulative effects are expected from the proposed action.

Snag Creation/Coarse Woody Debris

Direct: Potential habitat for epiphytic Survey and Manage or Special Status species associated with live trees would be lost when live trees are killed by turning them into snags and down woody debris. This loss should have no effect on the persistence of Survey and Manage or Special Status species.

Indirect: The creation of snags and coarse woody material may increase habitat for some species of Survey and Manage or Special Status species.

Cumulative: This will increase habitat for late-successional associated species within the subwatershed.

Port-Orford-cedar - No Action

There is no known Port-Orford-cedar in any of the harvest units or the rock quarry areas or along the proposed haul routes. There are no known direct, indirect or cumulative effects on the spread of the Port-Orford-cedar root rot disease by selection of the “No Action” alternative.

Port-Orford-cedar - Proposed Action

There is no known Port-Orford-cedar in any of the harvest units or the rock quarry areas or along the proposed haul routes. There are no known direct, indirect or cumulative effects on the spread of the Port-Orford-cedar root rot disease by selection of the “Proposed Action” alternative.

Snag Creation & Coarse Woody Debris Creation & In-stream Restoration

Direct: No direct effects

Indirect: No indirect effects

Cumulative: Same as “No Action” alternative.

Noxious Weeds - No Action

Direct/Indirect: There are no direct effects to noxious weeds as a result of the no action alternative. Quarry sites provide the disturbed habitat preferred by noxious weeds. These sites have some degree of noxious weeds present or near by which would not be treated, and are frequented by the public. The current rate of infestations, spread, and growth of noxious weeds would continue under the no action alternative. In the short term, the introduction of new species of noxious weeds or the spread of existing noxious weed populations could continue, especially along roads and in existing young plantations. Human and natural events will continue to introduce new weeds and/or create the sunlight and disturbed soil needed for weed establishment.

Cumulative: In the long term, noxious weed populations on Bureau of Land Management lands should decrease as a result of treatments and/or competition for light resources as weeds are shaded by surrounding maturing vegetation. Seed beds of some weeds can survive 100+ years, but current land classification and guidelines support no or limited vegetation denuding activities for time frames greater than 100 years. Therefore, most of these types of seedbeds should become non-viable. However, management activities on surrounding private lands and roads, or private and public use of Bureau of Land Management lands and roads could continue to introduce new noxious weeds or act as seed sources for establishment of individual plants or species at disturbed sites.

The no action alternative means these quarry sites will not be treated for noxious weeds, nor put to bed. The current rate of infestation, spread, and growth of noxious weeds could continue under the no action alternative. These sites would most likely continue to be seed sources for spreading noxious weeds.

Noxious Weeds - Proposed Action

Direct: Best management practices and project design features, including vehicle washing, should prevent the introduction and spread of noxious weeds. In addition, these types of activities do not provide the disturbed bare soil with significant sunlight needed for noxious weeds growth. Currently these areas are slated for noxious weed control along the road systems, including private lands. Existing roads are where the major weed populations are currently found and where they are being spread. These projects provide follow up treatments, allowing any funding to be spent in other needed areas. The current weed problem for this area is small. Under the proposed action alternative noxious weeds will be treated at the quarry sites and along haul routes reducing current populations. No indirect noxious weeds are anticipated.

Indirect: No indirect impacts are identified for these “proposed” actions.

Cumulative: The cumulative effects should be a slowing or elimination of the spread of noxious weeds along the road systems in this area. Since specific funding for weed treatment is limited the follow up treatments provided from these projects will be helpful in eliminating new infestations. In the long term noxious weed populations would return to conditions existing under the no action

alternative, with a possible increase in population size resulting from the increase in quarry area size/activities. These sites are very harsh and establishing native vegetation that will out compete noxious weeds is difficult.

Alder Conversion

Direct: While this type of activity favors bare disturbed soil and sunlight needed by noxious weeds, the application of best management practices and project design features should prevent the introduction and spread of noxious weeds. Any existing noxious weeds along existing haul routes will be treated under the contract.

Indirect: Harvest activities and site preparation could result in the death of mature noxious weed plants inside these units.

Cumulative: The result of pre-treating existing noxious weeds and logging with best management practices and project design features should reduce the numbers of noxious weeds. Should circumstances favor noxious weed establishment on the alder conversion areas, then populations could temporally increase until silvicultural treatments and competition or shade from native plants reduces these populations. The long-term effect should be the same as the “No Action” alternative.

Fuels Management

Direct: Any fuels treatment that generates bare soil and adequate sunlight will result in a habitat favorable to noxious weeds that could become established as a result of existing seed beds, near by seed sources, or accidentally introduced seed. Pre-treatment and project design features should prevent further spread of existing seed sources within the project area and introduction of seed from project activities. If seed is already present in the soil for species that benefit from heat scarification then those seeds would likely germinate if fire is used.

Indirect: Site preparation could result in the death of existing noxious weed plants. No indirect impacts are identified for these “proposed” actions.

Cumulative: In the short term given favorable conditions noxious weeds could increase, but is unlikely. The net long term effect should be the same as the no action alternative.

Road Construction & Road Renovation/Improvement/Maintenance/Decommissioning

Direct: Since noxious weeds along the roads in the area would be treated and best management practices and project design features that mitigate against noxious weed introduction, spread, or establishment will be applied, no direct effects on noxious weeds are anticipated.

Indirect: No indirect effects have been identified.

Cumulative: Given the poor soil conditions and harsh environment of road right-of-ways, establishment of native plants is difficult. The potential exists that exposed soil will favor establishment of noxious weeds. Other traffic will occur on these roads as the result of public and private activities that can introduce weed seeds from other areas. However, this area would be monitored for future treatments within the District.

Snag Creation & Instream Restoration & Coarse Woody Debris

Direct: No direct effects are anticipated. Best management practices and project design features should mitigate against any possible effects.

Indirect: No indirect effects are anticipated.

Cumulative: Same as “No Action” alternative.

Fuels Management - No Action

Direct - Under the no action alternative, no direct short-term consequences to the fuels and fuel loadings of the proposed project areas will occur.

Indirect - An indirect consequence of the no action alternative would be progressively stagnating stand conditions with associated mortality which over time may result in a build up and accumulation of dead or dying fuels both ground and aerially disposed. This condition could make the stands more susceptible to a damaging stand modifying fire and may hamper fire control efforts during a wildfire event.

Fuels Management - Proposed Action

Direct - Under the proposed action alternative, there would be a short-term increase in volatile fuel loadings and a short term increased risk of damaging wildfire in the affected areas. Associated with the proposed action would be increased human activity that would increase the possibility of human caused wildfire.

Indirect - Harvest activities would create openings in the project areas which may mimic openings caused by naturally occurring fire which has long since been eliminated from this environment. Thinning dense and stagnating stands will reduce the long-term vulnerability of the stand to the possibility of wildfire by removing or reducing the sources of future fuel loading.

Harvest activities would allow development of stand characteristics that are more representative of naturally occurring stands where natural fire had an influence on stand composition and diversity.

Smoke from prescribed fire activities would contribute to minor short-term increases in particulate matter in the surrounding air shed. All prescribed fire activities would be conducted in compliance with the Oregon Smoke Management Plan, (OAR 629-43-043). No adverse effects on designated air sheds are expected to occur due to distance to the nearest population center and timing of ignition.

Recreation - No Action

Direct/Indirect/Cumulative - There are no known impacts to recreation from the no action alternative.

It is recognized, however, that natural thinning over time may result in difficult access for animals and people due to dead trees on the ground.

Recreation - Proposed Action

The same recreation activities would likely occur in this region regardless of natural resource management activities. The changes would likely be more like shifts. Shifts in locations for favored activities; shifts in scenic vistas as the forest changes; shifts in roads and pull-offs used; and shifts in the location of animals affecting hunters and wildlife viewers. There are no planned recreation developments within the project area, though the District Resource Management Plan recognizes the potential for such developments. The proposed actions would not diminish that potential.

Project implementation may create temporary displacement for recreational activities. Alder conversion and commercial thinning would create some new openings, making those stands easier to see and walk through. New road construction would temporarily increase motorized access to public lands. Conversely, road decommissioning would decrease motorized access in the watershed. In-stream restoration may improve fishing opportunities. Snag creation could create a safety concern if there were numerous snags in a given area, particularly on windy days. In-stream restoration may increase pedestrian water crossings for animals and people.

Brief delays in travel would occur due to equipment on the roads. The activity and noise associated with logging may encourage some visitors to go elsewhere. Both motorized and non-motorized access would be temporarily diminished during implementation, for public safety.

Cumulative: There are no foreseeable cumulative impacts to recreation from the proposed action.

Area of Critical Environmental Concern

There will be no known impacts to the existing Area of Critical Environmental Concern or to the values for which it was established or designated. No proposals are planned within or adjacent to the Area of Critical Environmental Concern. Any future activities within or adjacent to the Area of Critical Environmental Concern must be consistent with the Area of Critical Environmental Concern management plan.

Cultural Resources - No Action

Cultural resources would be unaffected by the no action alternative, as no ground disturbing activity would take place.

Cultural Resources - Proposed Action

It is likely that cultural resources would be unaffected by the proposed action, as there are no known resources which would be subject to alteration by ground disturbance during thinning or conversion activities.

Solid & Hazardous Materials - No Action

No effects Anticipated

Solid & Hazardous Materials - Proposed Action

No effects are anticipated from the proposed action, unless a release of hazardous materials occurs as a result of operations. Depending upon the substance, amount, and environmental conditions in the area affected by a release, the impacts could range from and short term to more extensive and more lasting. Minor amounts (less than 2 gallons) of diesel fuel, gasoline or hydraulic fluid leaking from heavy equipment onto a road surface, with little or no chance of migrating to surface or ground water before absorption or evaporation, would be an example of minimal impact.

If a petroleum substance is released at or above the State of Oregon reportable quantity of 42 gallons, or has the likelihood of reaching ground or surface water regardless of amount, it could cause from more serious impact to the environment. This impact could range from localized contamination of soil and vegetation, to entry into surface water and toxic effects upon fisheries and aquatic life habitat. The greater the quantity of material released, the more the effects are likely to be, coupled with variable pathway conditions such as seasonal water levels, flow velocity, and rainfall.

Human health is not likely to be at risk under the proposed alternative.

Access road or skid trail closures will diminish the future potential for illegal dumping of solid and hazardous waste along roadsides and in riparian areas.

Energy Exploration, Development, Production, and Transportation – No Action – No effects Anticipated.

Energy Exploration, Development, Production, and Transportation – Proposed Action

As there are no road obliterations associated with this alternative, energy development will remain unchanged from its current condition.

References

- Adams, P.W.; Ringer, J.O. 1994. *The Effects of Timber Harvesting & Forest Roads on Water Quantity & Quality in the Pacific Northwest: Summary & Annotated Bibliography*. For. Eng. Dept., Ore. St. Univ. 147 pg.
- Allan, Marganne Mary. Soil Compaction and Disturbance Following a Thinning of Second-Growth Douglas fir with a Cut-to-Length and a Skyline System in the Oregon Cascades, Professional Paper, Department of Forest Engineering, Oregon State University, Sept. 1997.
- Anthony, R.G. and D. Gomez, 1995. unpublished, COPE Wildlife and Commercial Thinning Study: The Influence of Commercial Thinning on Flying Squirrels and Chipmunks in Forests of the Pacific Northwest.
- Beschta, R. L. 1978. *Long-term Patterns of Sediment Production Following Road Construction and Logging in the Oregon Coast Range*. Water Resources Research 14-6: pp 1011-1016.
- Bosch, J.M.; Hewlett, J.D. 1982. *A Review of Catchment Experiments to Determine the Effect of Vegetation Changes on Water Yield and Evapotranspiration*. J. Hydrol. 55:3-23.
- Brown, E.R. 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington, 2 vol. USDA, FS, PNW. Portland, OR.
- Brown, E.R., tech. ed. 1985. Management of Wildlife and Fish Habitats in Forest of Western Oregon and Washington. Part 1—Chapter Narratives, 332 pg. Part 2—Appendices, 302pg. Publ. R6 & WL-192-1985. Portland, OR: USDA, FS, PNW Region.
- Bureau of Land Management, Informational Bulletin No.OR-2000-092, Portland, Oregon
- Burroughs, E.R.; Thomas, B.R. 1977. Declining Root Strength in Douglas-fir After Felling as a Factor in Slope Stability. USDA For. Serv. Res, Paper INT-190.
- Chen, J., J.F. Franklin, and T.A. Spies. 1995. Growing-season microclimatic gradients from clearcut edges into old-growth Douglas-fir forest. *Ecological Applications* 5(1): 74-86.
- Chen, J. 1991. Edge Effects: *Microclimatic Pattern and Biological Responses in Old-Growth Douglas-fir Forest*. Dissertation. Univ. of Wash, Seattle.
- Cline, S.P.; Berg, A.B.; Wight, H.M. 1980. Snag Characteristics and Dynamics in Douglas-fir Forests, Western Oregon. *J. Wildl. Manage.* 44(4):773-786.
- Cook, J.E. 1996. Implications of Modern Successional Theory for Habitat Typing: A Review. *Forest Science* 42(1)67-73.
- Curran, Janet H. 1999. Hydraulics of Large Woody Debris in Step-Pool Streams, Cascade Range, Washington. Masters Thesis. Colorado State University
- CH2M Hill. 1993. *Coos County Water Supply Plan*. Prepared by CH2M Hill for Coos County, OR 1993.
- Daniels, T. W., Helms, J. A., and Frederick, B. S.. 1979. *Principles of Silviculture*. Second Edition. McGraw-Hill Company
- Deal, R.L.; W.A. Farr. 1994. Composition and Development of Conifer Regeneration in Thinned and Un-thinned Natural Stands of Western Hemlock and Sitka Spruce in Southeast Alaska. *Can J For Res* 24:976-984
- Emmingham, B., 1997. Thinning Westside Forests: Stand Development, Density Relationships and Management Objectives. Adaptive COPE.
- Emmingham, B.; Hibbs, D. 1997. Riparian Area Silviculture in Western Oregon: Research Results and Perspectives, 1996. Cope Report 10(1&2):24-27.
- Fahrig, L., J.H. Pedlar, S.E. Pope, P.D. Taylor, and J.F. Wegner. 1995. Effect of road traffic on amphibian density. *Bio. Conserv.* 73: 177-182.

- Forsman, E.D., E.C. Meslow, and H.M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs 87: 1 - 64.
- Forest Service, Intermountain Research Station, Engineering Technology, 1991. Level I Stability Analysis Version 2.0 (LISA 2.0). United States Department of Agriculture, Moscow, Idaho. Computer Software.
- Franklin, J.F.; C.T. Dyrness. 1973 (reprinted 1988) Natural Vegetation of Oregon and Washington. reprinted 1988 by Oregon State Univ. Press. 452.
- Franklin, J.F.; F. Hall; W. Laudenslayer; C. Maser; J. Nunan; J. Poppino; C.J. Ralph; T. Spies. 1986. Interim Definitions for Old-Growth Douglas-fir and Mixed Conifer Forest in the Pacific Northwest and California. Res Note PNW-447. USDA, FS, PNW Exp Stat. 7 pgs.
- Franklin, F.E.; M.A. Hemstrom. 1981. Aspects of Succession in the Coniferous Forests of the Pacific Northwest. In Forest Succession Concepts and Application, D.C. West; H.H. Shugart; D.B Botkin. Springer-Verlag, NY, Heidelberg, Berlin. pp 212-229.
- Fried et al. 1988. Bigleaf maple seedling establishment and early growth in Douglas-fir forests, Canadian Journal of For. Res. 18-1, 226-1, 233.
- Gibbs, J.P. 1998. Amphibian movements in response to forest edges, roads, and streambeds in southern New England. J. Wildl. Manage. 62:(2)584-589.
- Grenier, J.J. and S.K. Nelson. 1997. Marbled murrelet habitat association in Oregon. Pages 191- 201 in C.J. Ralph, G.L. Hunt, M. Raphael, and J.F. Piatt (Tech. eds.). Ecology and conservation of the marbled murrelet. Gen. Tech. Rept. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, F.S., U.S. Dept. of Ag. 420 pp.
- Hall, J.D.; Brown, G.W.; Lantz, R.L. 1987. *The Alsea Watershed Study: A Retrospective*, in: Streamside Management: Forestry and Fishery Interactions, Contrib. No. 57. edited by E.O. Salo and T.W. Cundy.. Univ. Wash. Inst. Forest Resources, Univ. of Wash., Seattle.
- Harr, R. D. and J. T. Krygeir. 1972. *Clearcut logging and lowflows in Oregon coastal watersheds*. Research Note 54. Corvallis, OR.
- Harr, R. D. 1976. *Forest practices and streamflow in western Oregon*. USDA Forest Service Gen. Tech. Rept. PNW-49, PNW Res. Sta., Portland, Oregon.
- Harr, R.D., R. L. Fredriksen, and J. Rothacher. 1979. *Changes in streamflow following timber harvest in Southwestern Oregon*. USDA Forest Service. RES. Pap. PNW-249.
- Harr, R. D. 1983. *Potential for augmenting water yield through forest practices in western Washington and western Oregon*. Water resources Bulletin 19(3):383-393.
- Harr, R. D., and B. A. Coffin. 1992. Influence of Timber Harvest on Rain-On-Snow Runoff: A Mechanism for Cumulative Watershed Effects. American Institute of Hydrology. Pp. 455-469.
- Harris, L.D. 1984. The Fragmented Forest. Univ of Chicago Press, Chicago & London. 221 pgs.
- Hicks, B. J., R. L. Beschta and R. D. Harr. 1991. *Long-term changes in streamflow following logging in western Oregon and associated fisheries implications*. Water Resource Bull. 27(2):217-225.
- Hemstrom, M.A.; Logan, S.E. 1986. Plant Association and Management Guide Siuslaw National Forest. USDA FS Pacific NW Region. R6-Ecol 220-1986a.
- Hostetler Bruce B. and Ross, Darrell W. 1996. Generation of Coarse Woody Debris Guidelines for Reducing the risk of Adverse Impacts by Douglas-fir Beetle. USDA Forest Service.
- Hicks, L.L; H.C. Stabins; D.R. Herter. 1999. Designing Spotted Owl Habitat in a Managed Forest. J of For. 97(7):20-25.

- Lyon, L.J. and A.L. Ward. 1982. Elk and land management. In: Thomas, J.W. and D.E. Toweill (ed). Elk of North America, ecology and management. Stackpole Books, Harrisburg, Pa. pp 443-477.
- Keim, R.F.; A.E. Skaugset; D.S. Bateman. 2000. Dynamics of Coarse Woody Debris Placed in Three Oregon Streams. *Forest Science* 46(1): 13-22.
- Kelty, M.J. 1986. Development Patterns in Two Hemlock-hardwood Stands in Southern New England. *Can. J. For. Res.* 16:885-891.
- King, J.E. 1966. Site Index Curves for Douglas-fir in the Pacific Northwest. Weyerhaeuser Forestry Paper. For. Res. Cntr. Centralia, WA. 49 pgs.
- Jackson, W.L.; and Van Haveren, B.P. 1984. *Rainfall-runoff Prediction and Effects of Logging: the Oregon Coast Range*. USDI. BLM. Denver Service Center, Denver, CO.
- Keller, E.A.; MacDonald, A.; Tally, T.; Merrit, N.J. 1995. *Effects of Large Organic Debris on Channel Morphology and Sediment Storage in Selected Tributaries of Redwood Creek, Northwestern California*. In: Nolan, K.M.; Kelsey, H.M.; Marron, D.C. (editors). Geomorphic processes and aquatic habitat in Redwood Creek Basin, Northwestern California. USGS Professional Paper 1454-P. pgs 1-29.
- Keppeler, E.T., and R.R. Ziemer. 1990. Logging Effects of Streamflow: Water Yield and Summer Low Flows at Caspar Creek in Northwestern California. *Water Resources Research*, 26(7): 1669-1679
- MacDonald, L. H. 1991. Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska. U.S. Environmental Protection Agency, Region 10. Seattle.
- Marcot, B.G. 1991. Snag Recruitment Simulator Model, vers 2.52w.
- Megahan, W.F. 1982. *Channel Sediment Storage Behind Obstructions in Forested Drainage Basins Draining the Granitic Bedrock of the Idaho Batholith*. In: Swanson, F.J.; Janda, R.J.; Dunne, T.; Swanston, D.N. (Editors), Gen. Tech. Rep. PNW-141. USDA, FS, Portland, OR. pgs 114-121.
- McArdle, R.E. 1961. The Yield of Douglas-fir in the Pacific Northwest, Tech Bull 201. Revised Oct 1949, slightly revised May 1961. USDA. FS. PNW Forest and Range Experiment Station. Reprinted by OSU Book Stores, Inc Corvallis OR in 1974. 74 pgs.
- Minore, D. 1979. Comparative Autecological Characteristics of Northwestern Tree Species - A Literature Review. Gen Tech Rept PNW-87. USDA, For Serv, PNW For & Range Exp Stat. 72 pgs.
- Miner, R., J. Buckhouse, and M. Borman. 1996. The Water Quality Limited Stream Segments list— What does it mean? Oregon State University Extension Service. Corvallis.
- Moore, J.A., and J.R. Miner. 1997. Stream Temperatures, Some Basic Considerations. Oregon State University Extension Service. Corvallis.
- Nelson, S.K. and T.E. Hamer. 1997. Nest success and the effects of predation on marbled murrelets. Pages 89 - 97 in C.J. Ralph, G.L. Hunt, M. Raphael, and J.F. Piatt (Tech. eds.). Ecology and conservation of the marbled murrelet. Gen. Tech. Rept. PSW-GTR-152. Albany, CA: Pacific Southwest Research Station, F.S., U.S. Dept. of Ag. 420 pp.
- Newton, M.; E. Cole. 1987. A Sustained-Yield Scheme for Old-Growth Douglas-fir. *Western J of Applied For.* 2(1):22-25.
- Newton, M.; E. Cole. 1994. Stand Development and Successional Implications: Pure and Mixed Stands. in *The Biology & Management of Red Alder*, editors: D.E. Hibbs; D.S. DeBell; R.F. Tarrant. OSU Press, Corvallis, OR. pp 106-115.
- Newton, M; B.A. El Hassan, J. Zavitkovski. 1968. Role of Red Alder in Western Oregon Forest Succession. In *Biology of Alder* J.M. Trappe; J.E. Franklin; R.F. Tarrant; G.M. Hansen eds. Portland OR. pp 73-84.
- Niemiec, S.S; G.R. Ahrens; S. Willits; D.E. Hibbs. 1995. Hardwoods of The Pacific Northwest. Forest Research Laboratory, Oregon State Univ. Corvallis. Research Contribution 8. 115 pgs.

- North, M.P.; J.F. Franklin; A.B. Carey; E.D. Forsman; T. Hamer. 1999. Forest Stand Structure of the Northern Spotted Owl's Foraging Habitat. *For Sci* 45(4):520-527.
- Noss, R.F. and A.Y. Cooperrider. 1994. *Saving nature's legacy*. Island Press, Washington, D.C. 416 pp.
- Oregon Department of Environmental Quality. 1998. Oregon's Final 1998 Water Quality Limited Streams-303(d) List.
- Oregon Department of Environmental Quality. 2000. <http://waterquality.deq.state.or.us/wq/303dlist/>
- (ODFW) Oregon Department of Fish and Wildlife. 1999. Surveying Oregon's Streams, "A Snapshot in Time". Aquatic Inventory Project, Training Materials and Methods for Stream Habitat Surveys. Portland.
- (ODFW) Oregon Department of Fish and Wildlife. 2001. ODFW Aquatic Inventory Project Stream Report – Tioga Creek. Corvallis.
- Oliver, C.D. and B.C. Larson. 1996. *Forest Stand Dynamics*. John Wiley and Sons, Inc. New York.
- Oliver, C.D.; Larson, B.C. 1990 *Forest Stand Dynamics*. McGraw-Hill, Inc. 467 pgs.
- Peet, R.K.; Christensen, N.L. 1987. Competition and Tree Death. *BioScience* 37(8):586-595.
- Reid, L. M. 1981. Sediment Production from Gravel-Surfaced Forest Roads, Clearwater Basin, Washington. Fisheries Research Institute. College of Fisheries, University of Washington. Seattle, Washington. FRI-UW-8108.
- Reid, L. M., and T. Dunne. 1984. Sediment Production From Forest Road Surfaces. *Water Resources Research* 20-11: pp 1753-1761.
- Reiter, M.L., and R.L. Beschta. 1995. *Cumulative effects of forest practices in Oregon*. Salem OR: Oregon Dept. of Forestry. Chapter 7.
- Reynolds, R.T. 1983. Management of western coniferous forest habitat for nesting accipiter hawks. GTR-RM-102. USDA, F.S., Rocky Mt. Forest and Range Experiment Station. Fort Collins, Co.
- Rosgen, D. L. 1994. *A classification of natural rivers*. *Catena* 22: pages 169-199.
- Seixas, Fernando. Effects of Slash on Forwarder Soil Compaction, Council on Forest Engineering, June 1995.
- Smith, D.M. 1962. *The Practice of Silviculture* 7th ed. John Wiley & Sons, Inc, NY. 578 pgs.
- Spence, B. C., G. A. Lomnický, R. M. Hughes, and R. P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6075. ManTech Environmental Research Services Corp., Corvallis, Oregon.
- Stewart, G.H. Population Dynamic of a Montane Conifer Forest, West Cascade Range, Oregon, USA. *Ecology*. 67(2):534-544.
- Stubblefield, G.; C.D. Oliver. 1978. Silvicultural Implications of the Reconstruction of Mixed Alder/Conifer Stands. in *Utilization and Management of Red Alder*, compiled by D.G. Briggs; D.S. DeBell; W.A. Atkinson. Gen. Tech. Rpt PNW-70. USDA. FS. PNW For. & Range Exp Stat, Portland, OR. pp 307-320.
- Tappeiner, J.C.; D. Huffman; D. Marshall; T.A. Spies; J.D. Bailey. 1997. Density, Ages, and Growth Rates in Old-Growth and Young-Growth Forests in Coastal Oregon. *Can. J. For. Res.* 27: 638-648.
- Thomas, J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. A Report by the Interagency Scientific Committee to address the conservation of the northern spotted owl. U.S. Department of Agriculture, Forest Service, and U.S. Department of the Interior, Fish and Wildlife Service, Bureau of Land Management, and National Park Service. Portland, Oregon.
- USDA; USDI. 1994. *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl - Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl*. FS; BLM, Portland OR..

- USDA; USDI. 1994 . *Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl*. FS; BLM, Portland OR.
- U.S. Department of the Interior, U.S. Department of Agriculture. 1998. South Coast - Northern Klamath Late-Successional Reserve Assessment.
- USDI 1994. Final Coos Bay District Proposed Resource Management Plan and Environmental Impact Statement, Volume II.
- USDI, Bureau of Land Management. 1995. *Coos Bay District Record of Decision and Resource Management Plan*. Coos Bay, Oregon. 99pp. Appendices.
- USDI, Bureau of Land Management. 2000. *East Fork Coquille Watershed Analysis*. Coos Bay, Oregon. 200pp. Appendices.
- USDI, Bureau of Land Management. 2001. *Draft Western Oregon Districts Transportation Management Plan*. Coos Bay, Oregon. 27pp.
- USDI, Bureau of Land Management. 2001. *South Fork Coos Watershed Analysis*. Coos Bay, Oregon. 186pp. Appendices.
- USDI. 1995. Forest Survey Handbook BLM Manual Supplement Handbook 5250-1 Oregon State Office Portland, OR.
- U.S. Fish and Wildlife Service. 1997. Recovery plan for the threatened marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. Portland, Oregon. 203 pp.
- Weikel, J. M., and J. P. Hayes. 1997. Habitat use by cavity-nesting birds in young commercially thinned and un-thinned forests. Coastal Oregon Productivity Enhancement Program (COPE) Report, vol 10, number 3 (November 1997); 2-6.
- Weyerhaeuser Co. 1995. Habitat conservation plan for the northern spotted owl on the Millicoma Tree Farm Coos and Douglas Counties, Oregon. Weyerhaeuser Company, North Bend, OR.
- Washington Forest Practice Board. 1992. Standard Methodology for Conducting Watershed Analysis Under Chapter 222-22 WAC-ver. 1.10 Oct 1992.
- Weikel, J.M.; Hayes, J.P. 1997. Habitat Use by Cavity-nesting Birds in Young Commercially Thinned and Unthinned Forests. COPE Report. 10(3):2-6
- Wemple, Beverley C., J. A. Jones, and G. E. Grant, 1996. Channel Network Extension by Logging Roads in Two Basins, Western Cascades, Oregon. Water Resources Bulletin, Vol. 32, No. 6.
- Wierman, C.A.; C.D. Oliver. 1979. Crown Stratification by Species in Even-aged Mixed Stands of Douglas-fir – Western Hemlock. Can. J. For. Res. 9:1-9.
- Wilson, J.S. and C. D. Oliver. 2000. *Stability and Density Management in Douglas-fir Plantations*. Canadian Journal of Forest Research. 30: 910-920.